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BADCOCK (W. J.). **Annual Report, British Solomon Islands Protectorate, 1946.**—13 pp., 1947. [Mimeographed.]

During 1946, the most serious plant disease in the Solomon Islands was a suspected virus disease of taro [*Colocasia antiquorum*] in the Shortlands. Sigatoka disease of bananas due to *Cercospora musae* [*Mycosphaerella musicola*: *R.A.M.*, xxvi, p. 250] is serious everywhere, but spraying is not feasible and the only practical remedy appears to consist in continuing the present method of growing isolated plants. On a few occasions, rice plots were virtually destroyed by *Helminthosporium oryzae* [*Ophiobolus miyabeanus*: ibid., xxvi, p. 167], but incidence was quite localized.

GIBBS (J. G.). **Abstract of Report on the work and findings of the Department of Agriculture, Falkland Islands, 1937 to 1946.**—13 pp., 1947. 1*s*.

During the period under review, small yields of swede seed were obtained in the Falkland Islands under somewhat adverse cultural conditions. The Colony appears to be free from insect carriers of *Phoma lingam*, so that a seed trade between the Falkland Islands and New Zealand in disease-free swede seed should be possible. The Colony also possesses the climate and the freedom from insect vectors of virus diseases necessary for the production of high-quality seed potatoes, for which potential markets exist in Uruguay and Argentina. *Synchytrium endobioticum* and *Spongospora subterranea* are present, but could be kept out of seed potato areas.

MILBRATH (D. G.). **Bureau of Plant Pathology.**—Ex *Rep. Dep. Agric. Calif., 1946* (*Bull. Dep. Agric. Calif.*, xxxv, 4), pp. 230–241, 191, 1 map, 1946.

In this report [cf. *R.A.M.*, xxvi, p. 189] it is stated that the peach mosaic eradication campaign was continued, the number of new cases noted being less than for any previous year. Altogether 536,147 trees were inspected and 914 new cases found. Newly infected properties numbered 54 with 95 infected trees. New peach varieties free from mosaic, grown on supervised plots within the quarantine area, have been released for general distribution.

G. L. STOUT reports that extensive vine inspections have shown that there was a considerable increase in Pierce's disease [caused by lucerne dwarf virus] in Stanislaus County [loc. cit.] during the year.

Examinations for chestnut blight (*Endothia parasitica*) [ibid., xxv, p. 15] showed an increase in the numbers of infected trees in San Joaquin County. It is suggested that the fungus entered into the trunks years ago through wounds resulting from removal of sprouts, but made only slow progress during many years.

In 1941 an unusual foliage spotting was discovered on a green-leaved variety of *Aucuba japonica*. The ring patterns, general distribution, development, and colour resembled the ring spot of peach leaves. The spots were very numerous, 1 to 5 mm. in diameter, small and medium-sized ones often showing a more distinct ring development than the larger. The rings were light green with medium-green centres. Leaves of all sizes and age were attacked. Patch bark grafts were placed on a healthy plant and after about 15 months the leaves of the inoculated plant showed the typical spots, suggesting that it is probably a virus disease.

G. KenKnight reports that the *Omphalia* Date Root Rot Survey [ibid., xxiv, p. 411], now in its second year, has as its objective the determination of sources of date offshoots which are free from *Omphalia* [*O. pigmentata* and *O. tralucida*]. About 240 orchards have been surveyed and 1,200 root samples examined, 11 per cent. of which showed *Omphalia*. It was isolated readily from weak palms and in orchards where decline symptoms were conspicuous, and was obtained only from rotten date roots and from necrotic root tips. These are abundant on weak palms, but also occur on apparently normal trees, from 70 of which *Omphalia* cultures were obtained, as they were from palms in 10 orchards where no decline symptoms were apparent. Cultures were also obtained from 16 of 26 orchards where the disease had not been reported prior to the survey. *Omphalia* was found on three palms originally obtained from Algeria and one from Egypt. Neither *O. tralucida* nor *O. pigmentata* was obtained from 44 root samples from the native palm *Washingtonia filifera*, but *Omphalia* was found on seedling palms growing 250 yds. away from palms derived from imported shoots.

In April, 1946, a new disease of sweet cherry trees was reported from an orchard near Brentwood, Contra Costa County. The malady did not spread to surrounding orchards and only Bing trees were affected. The symptoms of the disease were blistering of the bark of large limbs with subsequent roughening; small, brown, necrotic leaf flecks which eventually dropped out, leaving a shot-hole effect; and bud failure, followed by death, of one-year-old twigs. Severely affected trees showed many dead twigs and were much smaller in the top. A virus disease is suspected.

In order to prevent further spread of yellow bud mosaic of peach [ibid., xxvi, p. 189], which is widely distributed in the Winters and Suisun Valley areas, a quarantine regulation was issued in 1945 which prohibited the removal of all almond, apricot, nectarine, and peach trees from the infected area.

Western celery mosaic [celery mosaic virus: ibid., xxvi, p. 148] was more widely distributed than in previous years. It occurred in San Joaquin Delta, Salinas Valley, Santa Clara Valley, and Santa Maria district. In the controlled areas where the crop-free period method is employed, the occurrence was very slight.

In the report of the Bureau of Entomology and Plant Quarantine, H. Wallace (pp. 190–193) states that tomato-growers in Kern County and melon-growers in Stanislaus County suffered serious losses due to a high incidence of beet curly top virus transmitted by a high leafhopper population. The losses among spring-planted tomatoes were for Kern County 33·5 per cent., Tulare 26 per cent., and Fresno 16·8 per cent.; and among summer-planted tomatoes in Kern County 53·1, and Tulare 10·3 per cent. Spray applications alone are not sufficient to control leafhoppers in years of great abundance. The effectiveness of Russian thistle [*Salsola kali* var. *tragus*] elimination is stressed.

Bertus (L. S.). **Plant pathology.**—*Adm. Rep. Dir. Agric., Ceylon, 1945*, pp. D9–D11, 1946.

During the period under review [cf. *R.A.M.*, xxv, p. 27] the following diseases were observed for the first time in Ceylon: onion 'blast' of physiological origin [ibid., xxiv, p. 48], *Sclerotium rolfsii* attacking garlic leaves and bulbs, *Rhizoctonia* [*Corticium*] *solani* causing damping-off of lime [*Citrus aurantiifolia*] seedlings, mango flower mildew (*Oidium* sp.) [? *O. mangiferae*: ibid., xxi, p. 31], and dry rot of sugar-cane (*Botryodiplodia theobromae*) [ibid., xviii, p. 624].

The progress of the root disease caused by *Xylaria thwaitesii* in four rubber trees [ibid., xviii, p. 579] on a steep slope in the Galagedera district was observed to be very slow.

Ten five-year-old coco-nut palms in the vicinity of Matale were killed by bud rot (*Phytophthora palmivora*), being traced to the severely diseased fruits of a breadfruit [jak: *Artocarpus integer*] tree in their midst.

Of 90 orange, mandarin, and grapefruit trees suffering from pink disease [*C. salmonicolor*] at Nalanda Fruit Station, 21 had to be eradicated, while the remainder were treated by excision of the infected branches, painting the healthy ones, especially at the forks, with brunolinum plantarium solution, tarring the cut ends, and spraying with colloidal copper.

In connexion with the plantain bunchy top eradication campaign [ibid., xx, p. 290] 560,086 diseased plants were uprooted and destroyed, and visits paid to 55 gardens covering 203 acres to inspect the work already done.

A fortnight after the inoculation of 100 lb. straw on 25th May with a pure culture of *Volvaria diplasia* [ibid., xxiii, p. 166], mushroom production began, and the final yield reached 2 lb. 1½ oz. The average temperature during this period was 80·6° F.

Bremer (H.), İşmen (H.), Karel (G.), Özkan (H.), & Özkan (M.). **Beiträge zur Kenntnis der parasitischen Pilze der Türkei. I.** [Contributions to knowledge of the parasitic fungi of Turkey. I.]—*Rev. Fac. Sci. Univ. Istanbul*, Ser. B, xiii, 2, pp. 122–172, 1 pl., 2 figs., 1947. [Turkish summary.]

The observations comprised in this first instalment of an account of the parasitic fungi [and bacteria] of Turkey cover the period from 1938 to 1946 and include the following. Crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, xiii, p. 16] is occasionally found on beet and is widespread on peach, plum, and quince, while reports of its occurrence on apricot, sour cherry, pear, and apple have also been received. The disease assumes a destructive form on vines, killing numerous stocks. *P.* [*Xanthomonas*] *phaseoli* was identified for the first time in Turkey as the agent of a blight of bean (*Phaseolus vulgaris*) leaves, stems, and pods. Twenty-five seeds from diseased plants gave rise to six (24 per cent.) seedlings with primary infection. *Pseudomonas* [*X.*] *malvacearum* attacks both *Gossypium herbaceum* and *G. hirsutum* but is not reckoned among the principal pests of the cotton crop. Olives in the coastal regions of south-western Anatolia sustain considerable damage from knot disease (*P. savastanoi*). Tobacco wildfire (*P. tabacum*) appears to be co-extensive with the cultivation of the crop.

P. [*Bact.*] *sesami* is believed to be the causal organism of a wilt of sesame [ibid., xiii, p. 565] apparently new to Turkey but possibly identical with the bacteriosis described by Malkoff from Bulgaria [*Zbl. Bakt.*, Abt. 2, xi, pp. 333–336, 1904; xvi, pp. 664–666, 1906]. Primary infections on the leaves often appear as angular, vein-delimited, brown spots with blackish-brown margins, attaining a diameter up to 2 cm. and coalescing to produce a dark network on a brown ground. Primary infections on the stems commonly occur at the site of insertion of the petioles, while girdling may lead to the collapse of the whole plant. Sections through the stems reveal the permeation of the cortex by large irregular lacunae, in which the tissue is totally disorganized and filled with bacteria. In severe cases the vascular bundle ring is disrupted in places and infection advances into the medulla, while the vessels may also contain bacteria; these were isolated in pure culture on potato agar, on which they formed circular, slimy to liquid, lustrous, whitish-grey, faintly pink-tinged colonies with entire margins. Inoculations on healthy sesame plants with diseased material and pure cultures of the bacterium resulted in the development of typical symptoms of the wilt. The disease may assume considerable economic importance in a region such as the Anatolian plateau, where the abrupt changes of temperature adversely affect the crop. The average numbers of capsules on ten healthy and ten partially wilted plants were 10·8 and 4·9, respectively.

Olpidium brassicae was commonly observed in the roots of young tobacco plants [*R.A.M.*, xix, p. 308] but no correlation could be traced between its presence and chlorosis, which is considered more likely to be due to non-parasitic factors such as excessive humidity and unduly close spacing.

Albugo candida [*Cystopus candidus*: ibid., xiv, p. 1 *et passim*] was found on mustard, radish, and various wild plants. Vine downy mildew (*Plasmopara viticola*), though widespread in Turkish vineyards, does not cause the devastating losses experienced in more humid climates, at any rate on the central Anatolian plateau. In the south-west of the province, one or two prophylactic treatments with Bordeaux mixture are usually applied in the spring. Further applications are required only in the exceptional seasons with abnormally heavy spring and early summer rainfall, such as 1940, when up to 80 per cent. damage was recorded owing to neglect of this precaution.

Lettuce downy mildew (*Bremia lactucae*) [ibid., xxvi, p. 3] is invariably associated with low temperatures and a fairly high degree of humidity, infection being normally confined to the basal leaves and causing material damage only on winter crops in the Izmir region. Other hosts of the fungus are the wild lettuce, *Lactuca scariola*, and *Carduus pycnocephalus*, the conidia on the last-named measuring 15 to 19 by 14 to 17 μ.

Taphrina deformans is widespread and destructive on peaches, trees with every leaf infected being no exception. Almonds are also regularly attacked by the leaf curl in a milder form. *T. pruni* appears to be prevalent on plums.

Cereal mildew (*Erysiphe graminis*) is prevalent in the Izmir region, where the mild, damp, Mediterranean winter favours the development of the fungus on oats, *Avena sterilis*, wheat, and barley. It is pre-eminently a disease of young plants, very little infection occurring on barley, for instance, once the ears begin to emerge, irrespective of the date of sowing. A varietal test showed that the very slowly developing Guzak barley was more severely attacked at all stages than the more rapidly growing California and Elsisehir varieties, the counts on a scale ranging from 0 (immune) to 5 (very severe infection) on 30th January, 13th February, 7th and 28th March, and 26th April, 1939, being 1·6, 2·2, 2·8, 0·9, and 0, respectively, for the first-named, 1·1, 1·5, 1·7, 0·3, and 0 for the second, and 0·9, 1·2, 1·1, 0·4, and 0 for the third, with averages of 1·5, 0·9, and 0·7, respectively. A cold, dry spell, resulting in a check to growth at the critical phase was evidently the primary cause of the outbreak [cf. ibid., xxiii, p. 292]. In another test in 1939–40 to determine the influence of the sowing date on the incidence of mildew, the percentages of infection on 30th April for the 7th October, 12th December, 30th January, and 28th February series were 0, 0, 48, and 68, respectively, while by 10th May perithecia had developed on the dry basal leaves in the two latter [cf. ibid., xvi, p. 801]. Here correlation between the stage of growth of the plants and the incidence of mildew is again exemplified.

E. pisi was observed on winter pea crops in the vicinity of Izmir only. The dimensions of the conidia, perithecia, asci, and ascospores of a strain of the fungus from lucerne at Ankara were 32 to 34 by 14 to 19, 94 to 143, 57 to 82 by 28 to 45, and 17 to 29 by 11 to 15 μ, respectively, compared with those of Blumer's mid-European strain, which measured 27 to 33 by 14 to 17, 85 to 126, 50 to 60 by 30 to 40, and 22 to 27 by 13 to 16 μ, respectively [ibid., xiii, p. 127].

True mildew of the vine (*Uncinula necator*) is prevalent both in the Mediterranean zone and the Anatolian plateau, causing damage on an economic scale.

Microsphaera alphitoides [ibid., xxvi, p. 363] develops every year on oaks (*Quercus pedunculata*) near Ankara, regularly forming perithecia in the autumn: these organs measure 100 to 143 μ, the conidia ranging from 28 to 36 by 16 to 20 μ and the ascospores 20 to 29 by 10 to 14 μ.

Leveillula (*Oidiopsis*) *taurica* is of great importance in Turkey, where its many hosts include potato [ibid., xxiv, p. 476], eggplant (which sustains up to 90 per cent. defoliation), chilli, lucerne, *Glycyrrhiza glabra*, *Tropaeolum majus*, *Althaea cannabina*, *Plumbago europaea*, and almost certainly *Abelmoschus* [*Hibiscus*] *esculentus*.

Flax is infected by *Oidium lini* [ibid., xxiv, p. 450], the cylindrical conidia of which measure 24 to 37 by 11 to 14 μ.

Diplocarpon rosae was found on an undetermined species of rose in its imperfect state (*Marssonina rosae*), the conidia measuring 15 to 23 by 6 to 11 μ.

N. İyriboz reported in 1941 that *Claviceps purpurea* was of rare occurrence on rye in Turkey, but in 1943 O. Tosun collected numerous ergot sclerotia on the F_1 progeny of spontaneous rye × wheat hybrids at Ankara.

Polystigma rubrum is very widely distributed on plums [ibid., xxv, p. 457] and almonds, the latter including *Amygdalus* [*Prunus*] *webbii*.

According to N. İyriboz (1938) *Rosellinia necatrix* is a common agent of root rot in vineyards. Presumably this is also the fungus responsible for heavy losses in the Sari Lop fig variety (the well-known 'Smyrna fig' of commerce), but fruit bodies were not available for determination.

Mycosphaerella fragariae was frequently observed on cultivated strawberries in the Izmir and Ankara districts. *M. sentina* occurs on pears [ibid., xxvi, p. 64] throughout the country.

Some of the information assembled on apple, pear, and loquat scab (*Venturia inaequalis*, *V. pirina*, and *V. inaequalis* [*Fusicladium dendriticum*] var. *eriobotryae*) has already been published [ibid., xxv, p. 373]. The perithecia of *V. pirina* mature in the Ankara district from February to early April [cf. ibid., xxv, p. 399], and the first ascospore discharge in 1942 occurred on 24th April and in 1944 on the 13th, both wet days. Viable conidia were found through the summer in one- and two-year-old scab lesions on the branches. The segregation of *V. pirina* into morphological races [ibid., xvi, p. 618 *et passim*] was corroborated. Scab losses may be heavy in wet seasons.

Leptosphaeria salvinii was found to be prevalent on rice in the sclerotial state (*Sclerotium oryzae*) [ibid., xiii, p. 322] only, this being apparently the first record of its occurrence in the Near East. The indigenous Pembe Gomlek variety was observed to be very susceptible, but the damage caused by the fungus seems to be generally inconsiderable. Another rice pathogen new to Turkey is *Ophiobolus miyabeanus* in the conidial state, *Helminthosporium oryzae*. The conidia are 3- to 10-, mostly 7- to 8-septate and measure 13 to 102 by 10 to 16 (average 60 to 70 by 12·5) μ and are thus even more minute than the otherwise similar small-spored Japanese form described by Wollenweber in Part II of Sorauer's 'Handbook of plant diseases' (fifth revised edition) [ibid., xi, p. 527]. In pure culture the fungus grew almost equally well at 20° to 25° and 25° to 30° C., but its development was noticeably retarded at 15° to 20°.

Valsa cincta [ibid., xxii, p. 41] is very widely distributed on dry apricot branches in the pycnidial state (*Cytospora cincta*). The fungus, not hitherto reported from Turkey, is thought to play only a secondary part in the die-back of trees weakened by extremes of frost and drought.

The conidial state of *Sclerotinia fructigena* was collected in a number of localities on peach, apple, quince, and pear, while *S. laxa* stat. conid. is found annually on apricots suffering from die-back [ibid., xxii, p. 71].

Plant pathology, plant physiology, entomology, and vegetable crops.—*Rep. Hawaii agric. Exp. Sta., 1944–1946*, pp. 67–145, 3 figs., 1947.

The following items of interest are in this report [cf. *R.A.M.*, xxiii, p. 7]. J. W. Hendrix (pp. 101–102) reports that the technique for testing segregating populations of tomatoes for resistance to grey leaf spot (*Stemphylium solani*) [ibid., xxv, p. 143] has been modified, a standardized inoculum of conidia replacing the mycelial suspension which was found to be unsatisfactory. The cultures produced few or no spores under a variety of ordinary conditions, but when subjected to ultra-violet rays for two minutes (Sterilamp model WL-44, with WL-782-30 Sterilamp

globe, at 15 cm. distance) increased sporulation for inoculating purposes was obtained. Twenty single spore isolates of *S. solani*, applied as mycelial suspensions to Bounty, Pan America, Pritchard, and Rutgers tomato plants, showed the same range of pathogenicity on all four varieties. Culture No. 419 with a rating of 4·6 (5 denotes complete defoliation) proved to be the most pathogenic, No. 431 with 2·9 least so.

The same author in conjunction with W. A. Frazier, K. Kikuta, and J. S. McFarlane (pp. 141–143) developed hybrids resistant to spotted wilt [tomato spotted wilt virus], grey leaf spot, and *Fusarium* wilt [*Fusarium bulbigenum* var. *lycopersici*: loc. cit. and ibid., xxvi, p. 472 *et seq.*]. The testing technique for each line was as follows: seeds were sown in sterilized soil, watered with *Fusarium*-oat inoculum (25 c.c. inoculum to 200 c.c. water), and covered with soil. After 12 days a spore suspension of *S. solani* was sprayed over the cotyledons and the plants placed in a humidity chamber for about 48 hours. Grey leaf spot lesions were observed within 24 hours after removal from the chamber and the infected plants eliminated. After four to eight days the roots were dipped in *Fusarium*-inoculum and the transplated seedlings placed in shade for two to five days, then moved to the spotted wilt nursery where, after three or four weeks, the *Fusarium* and spotted wilt-susceptibles and those of inferior quality were destroyed. Since resistance to each of the three diseases appears to depend on single, dominant genes, it is important to test F_3 selections for homozygous resistance to any one or a combination of the diseases. Some F_3 lines, in which the F_1 and F_2 generation were given the three-way resistance test described, have shown remarkable resistance to all three diseases. In one line, secured by repeated back-crosses to Bounty, there appears to be a marked tendency for grey leaf spot-susceptible plants to be susceptible to *Fusarium* and the resistant plants to be resistant to both. Though the association is by no means complete, it may be important, because the elimination of grey leaf spot-susceptibles in the cotyledon stage may include a relatively high proportion of *Fusarium*-susceptibles. No breeding material resistant to *Alternaria solani* being available, some tolerant lines from the United States were used to procure hybrids with the combined resistance (grey leaf spot, spotted wilt, and *Fusarium*) lines.

Eight fungicides were tested in seven spray applications by J. W. Hendrix, M. Matsuura, and K. Kikuta in 1945 on the Hes 1516 selection of Pearl Harbor tomato for the control of *S. solani*. All plants treated with fungicide with the exception of Bordeaux mixture gave significantly higher yields than the untreated, the highest being those treated with zerlate (2 lb. to 100 gals.) 25·21 tons per acre, fermate (2–100) 23·96, dithane+zinc sulphate+lime (1½–1–½) 23·65, tribasic copper sulphate 22·27, the controls yielding 17·44. Only dithane (at the first application) and Bordeaux (throughout the spray period) caused injuries to the plants.

D. D. Jensen reports (p. 67) a new virus disease of papaw named 'ringspot' was discovered in March 1945 on the windward side of the island Oahu in the vicinity of Kailua, and scattered diseased plants were also found in Honolulu. The affected trees showed yellow rings on the colouring, mature fruits, a mosaic and dwarfing of the leaf lamina, stunting of the trees, decrease in size of fruits, and a reduced yield. *Myzus persicae*, the most common aphid on papaya, is the most efficient vector, and three species of *Aphis* also transmitted the virus. Field studies by R. C. Linder, W. Ikeda, and M. Awada (pp. 118–119) showed that vigorous trees were most easily infected. The disease spreads rapidly during the cooler months, and slowly during the hot and dry periods. Papaw production in the severely infected Kailua area suffered almost total losses. Eradication of affected plants has apparently prevented a recurrence of the disease.

Investigations of seed and mechanical transmission of papaw ring spot by J. W. Hendrix and M. Matsuura revealed that seedlings from 1,000 seeds from

diseased trees and 1,000 from healthy ones showed no difference in appearance. Transplanted to the field no evidence of the disease appeared after three months, and the virus did not spread from artificially infected soil to the growing seedlings. Mechanical transmission to healthy trees was secured by injection and rubbing with infected sap, symptoms appearing in 12 to 18 days.

Resistance to tobacco [ibid., xxvi, p. 35] and cucumber mosaic viruses in tomato has been investigated by K. KIKUTA and W. A. FRAZIER (pp. 140–141) in several field tests. *Lycopersicon hirsutum* has shown no mosaic symptoms in the field. The F_1 hybrids between (Michigan State Forcing × *L. peruvianum*) × *L. pimpinellifolium* and *L. hirsutum*, and between Pan America and *L. hirsutum* developed mild mosaic symptoms under field conditions. The F_1 hybrid between (*L. hirsutum* × Bonny Best) × (Bounty × BC–10) and *L. peruvianum* showed some degree of tolerance, and two F_2 segregates from a cross between (*L. hirsutum* × Bonny Best × Bonny Best) and Pearl Harbor × (*L. esculentum* × *L. pimpinellifolium* × *L. chilense*) showed the highest degree of tolerance to mosaic.

Pole green beans [*Phaseolus* sp.] resistant to rust [*Uromyces appendiculatus*: ibid., xxvi, p. 325] have been bred at Makawao on Maui by W. A. FRAZIER and J. W. HENDRIX (p. 143) during artificially induced rust epidemics, HES 494, 538, and 574 being the most promising lines.

Several cucumber varieties, resistant to cucumber mosaic virus [ibid., xxvi, p. 279], have been grown in observation plots by W. A. FRAZIER (p. 144). Kansas 6411, Puerto Rico 39, and Burpee Hybrid have been the most promising for tolerance to mosaic.

K. KIKUTA reports (pp. 144–145) that the most destructive [chilli] pepper disease on the islands is mosaic [cf. ibid., xxii, p. 275; xxvi, p. 525] causing sometimes 100 per cent. infection in the fields. Several varieties reported to be resistant to tobacco mosaic proved susceptible to the local mosaic strain. Puerto Rico Selection 25 was very susceptible, Tabasco, Red Chili, and Small Chili being somewhat tolerant. A field selection 'Waialua' apparently highly tolerant to the pepper strain is susceptible to tobacco mosaic virus. Hybrids between the Waialua variety and the tobacco mosaic resistant Princeton have been produced and tests are in progress.

Of the 125 U.S.D.A. and Wisconsin new potato varieties and seedlings listed for resistance to early and late blight [*Alternaria solani* and *Phytophthora infestans*] at the Poamoho Experimental Farm and the Haleakala Branch Station, 30 selections showed resistance or tolerance to early and/or late blight. The most promising was B 70–5, an unnamed U.S.D.A. seedling which has been tested for two years on Oahu, Maui, and Hawaii. It produced a large yield of good-quality potatoes and was highly resistant to late blight, but extremely susceptible to early blight. One selection from a cross between Mohawk and 96–56 has been resistant to both early and late blight.

J. W. HENDRIX (pp. 102–103) describes a leaf spot of lettuce, caused probably by a species of (?) *Stemphylium*. In 1945, in the vicinity of Waimea it destroyed about 75 per cent. of the crop during February, March, and April. The same disease occurred later in the Volcano district and at the University Farm, Oahu. The infected plants showed small, somewhat sunken, light brown, circular spots (1·5 to 3 mm. in diameter) on the outer leaves and exposed midribs. Favoured by the warm, wet weather the disease spread rapidly. With the onset of drier weather, plants in pre-head stage, even if heavily spotted, were able to recover, but older plants were defoliated and killed. Single-spore isolations of the fungus showed a higher degree of virulence.

A fungus also probably a species of *Stemphylium* was responsible for a leaf spot disease of pigeon peas (*Cajanus cajan*) in the early spring of 1945 on Maui and Oahu. The mycelium obtained from single spores and spore suspensions in greenhouse

tests caused severe spotting and defoliation. Mauritius was among the more susceptible varieties.

J. W. Hendrix, M. Matsuura, and K. Kikuta (pp. 104–107) used Bliss Triumph potatoes infected with early blight (*Alternaria solani*) for spray treatments with yellow cuprocide, tribasic copper sulphate, and spray-cop; the yields of 155, 159, and 161 bags per acre, respectively, were slightly better than the control (143) whereas zerlate, fermate, and dithane with 203, 218, and 212 bags, respectively, were significantly better.

Ten flowering branches of eight mango trees of four different varieties were sprayed with various fungicides at Poamoho, Oahu, in early spring of 1946. All the fungicides, applied five times, tended to reduce anthracnose [*Glomerella cingulata*: ibid., xx, p. 27; xxi, p. 504] loss. The numbers of fruits reaching maturity without evidence of anthracnose were, using phygon, 36; puratized N5 E, 28; isothan Q15, 25; fermate, 25; zerlate, 24; yellow cuprocide, 18; dithane, 13; control, 6.

Seven fungicides were tested under greenhouse conditions for effectiveness in preventing damping-off of papaw seedlings for which 100 seeds of inbred Line No. 5 of the Solo papaw were used. The seedling emergence for phygon was 800; Dow 9B, 718; spergon, 716; semesan, 698; arasan, 658; yellow cuprous oxide, 608; zerlate, 532; and control 578. Post-emergence damping-off during a 20-day period was 0, 23, 10, 35, 6, 2, 7, and 124, respectively. Zerlate delayed emergence and retarded growth. A second test was conducted in January, 1946, using the same fungicides and the same line seeds. Phygon, Dow 9B, and spergon again improved emergence percentages and post-emergence damping-off, the stand counts three weeks after emergence being, 856, 826, and 782, respectively (untreated 701).

Havas (L. J.). **L'évolution graduelle d'anomalies morphologiques y compris la polyploidie, induites chez le Pelargonium zonale par inoculations répétées du Bacterium tumefaciens.** [The gradual evolution of morphological anomalies, including polyploidy, induced in *Pelargonium zonale* by repeated inoculations with *Bacterium tumefaciens*.]—*Bull. Acad. Belg. Cl. Sci.*, Sér. 5, xxviii, 4–6, pp. 318–340, 4 figs., 1942. [Received August, 1947.]

At the Laboratory of Pathological Anatomy, University of Brussels, slips of the Metax (Meteor Atkinson) variety of *Pelargonium zonale* from asexually propagated parent stocks were inoculated in three series of tests (September, 1932, September, 1933, and May, 1936) with massive doses of virulent cultures of *Bacterium tumefaciens*. During the ten years following the first inoculation, the plants underwent a gradual transformation and segregation into two main types, morphologically and physiologically divergent. One of these, evidently an expression of auto- or allopolyploidy, reproduced the essential characters of gigantism, the plants becoming tetraploid and in some cases producing ascidiform leaves. The other type was marked by the excessive length and fragility and partial plesiasma of the stems (Fermond's term for the arrangement of the internodes in serried rows a few millimetres in length alternating with very long intervening spaces). Some of the plants thus affected also lost their negative geotropism and assumed a 'weeping' habit. Since these individuals remained diploid, the anomalies of growth are presumed to originate in a somatic mutation of the genes.

In a control series of inoculation experiments, using attenuated cultures of *Bact. tumefaciens*, heteroauxin, methylcholanthrene, and colchicine, effects similar to the foregoing were obtained, suggesting that the presence of the pathogen in a virulent form is not an indispensable condition for the development of the changes described. The latter are attributed, to a large extent at any rate, to the action of endogenous growth hormones [cf. *R.A.M.*, xvii, p. 661].

GARCÉS (C.). **La escoba de bruja del Cacao.** [Witches' broom of Cacao.]—*Rev. Fac. Agron. Medellin*, vi, 24, pp. 329–369, 1946.

This is a survey of the outstanding contributions to the literature on witches' broom of cacao [*Marasmius perniciosus*], arranged under the headings of host range, varietal susceptibility, terminology, history, geographical distribution, economic importance, symptomatology, etiology, epiphytology, and control by (*a*) exclusion, (*b*) eradication, (*c*) protection, and (*d*) immunization [*R.A.M.*, xvii, p. 801 *et passim*]. A bibliography of 65 titles is appended.

CROWDY (S. H.). **Observations on the pathogenicity of Calonectria rigidiuscula (Berk. & Br.) Sacc. on Theobroma cacao L.**—*Ann. appl. Biol.*, xxxiv, 1, pp. 45–59, 2 pl., 1947.

Infection by *Calonectria rigidiuscula* [*R.A.M.*, xxv, p. 548] is associated with four disorders of cacao in West Africa; canker (*Phytophthora palmivora*) [ibid., xxvi, p. 238]; injury by the capsids *Sahlbergella singularis* and *Distantiella theobroma* [ibid., xxvi, p. 190]; and acute and chronic die-back [ibid., xxi, p. 409]. Acute die-back caused a considerable amount of damage during 1944–5 in the Gold Coast. It is very destructive and has not apparently been reported before in the colony. The fungi most commonly recovered from affected trees were *C. rigidiuscula* and *Botryodiplodia theobromae* but as acute die-back occurs only after exceptional drought it may be considered to be due primarily to lack of moisture. Only *C. rigidiuscula* is present in the claret-coloured area of recently infected xylem of trees suffering from chronic die-back, typical symptoms of which are associated with trees already severely damaged either by acute die-back, capsid attack, or the falling of large forest trees. Canker affects the peripheral tissues of old trunks. In both the Gold Coast and Surinam, *C. rigidiuscula* infection is characterized by marked discoloration of the xylem in cankers caused primarily by *P. palmivora* and retards the healing of the cankers. Stems of all ages were artificially inoculated with pure cultures of *C. rigidiuscula*; they were successful only in wounded stems and in these the fungus established itself easily. Six months after mature stems had been inoculated healing was less advanced than in the uninoculated, but the presence of the fungus appeared only to check the development of the callus tissue. In one set of inoculations less than half the infected lesions were occluded after eight months, whereas in the controls all were occluded. Younger stems (½ to 1½ in. diam.) were inoculated by the insertion of conidia beneath a raised patch of bark which was afterwards bound back into place. Inoculation killed the bark patch in all, compared with 54 per cent. killed in the controls. In many cases the wood lesions had been occluded and the healing completed after seven months. Needle inoculations of soft green stems with spore suspensions caused tissue necrosis and blisters around the puncture with a marked discoloration of the xylem tissues. The presence of *C. rigidiuscula* in infected capsid lesions on woody shoots caused the damage to spread from the peripheral tissues to the xylem and phloem [ibid., xxv, p. 548]. Eventually the tissues die and the lesions callus over.

In the early stages of acute die-back the part played by *C. rigidiuscula* appears to be that of a mild parasite in a weakened tree and it assumes primary importance only after the acute phase of the disease has passed, when the fungus continues to spread slowly in the healthy wood. Many infected cankers even on a vigorous tree may cause serious harm once the fungus reaches the xylem. Chronic die-back appears to be the end stage of *C. rigidiuscula* infection. Its development is almost inevitable once the tree has been weakened either by infected capsid attack, acute die-back, or infected canker, and the fungus has gained entry. Dead wood should be destroyed to reduce the reservoir of infection in the field.

BAKER (R. E. D.) & DALE (W. T.). **Notes on a virus disease of Cacao.**—*Ann. appl. Biol.*, xxxiv, 1, pp. 60–65, 1 pl., 5 diags., 1 map, 1947.

The symptoms and distribution of the virus disease of cacao in Trinidad have been described previously [cf. *R.A.M.*, xxvi, p. 48]. Recent observations indicate that the disease may cause both die-back and a reduction in yield. Although the rate of spread may vary somewhat, after 10 months an average increase of 41 per cent. over the original number of infected trees had occurred. Clone I.C.S. 6 can be used as a differential host for identifying the two strains of the virus [loc. cit.], strain A causing red mottle only and B producing mosaic as well as mottle.

Both strains were readily transmitted by budding, the incubation period varying from 34 to 136 (average 90) days. At present there is little reason to believe that any cacao varieties are immune or even symptomless carriers.

SPRAGUE (R.). **Additional parasitic fungi on cereals and grasses in Washington.**—*Plant Dis. Reptr*, xxxi, 6, pp. 240–242, 1947. [Mimeographed.]

Among the root-invading fungi isolated from the roots of Gramineae during the spring of 1947 from collections made in eight counties of eastern Washington the most prevalent was *Fusarium nivale* [*Calonectria graminicola*: *R.A.M.*, xxv, p. 552]. *Pythium arrhenomanes* [ibid., xxv, p. 299], not previously reported from the State, was isolated from the roots of winter wheat. A partial list of the isolations and some miscellaneous collections representing additions to the flora of the State, is appended.

SEMPIO (C.). **Sulla resistenza agli attacchi di Erysiphe graminis tritici offerta dall' Avena, dal Granoturco e dal Frumento esposto a luce continua.** [On the resistance to the attacks of *Erysiphe graminis tritici* offered by Oats, Maize, and by Wheat exposed to continuous illumination.]—*Riv. Biol.*, xxxvi, pp. 43–66, 11 figs., 1943. [Received 1946.]

On a red Swedish variety (Segrahavre) of oats used in the author's experiments at the University of Perugia, the conidia of *Erysiphe graminis tritici* germinated less profusely than on wheat, and the germ-tubes were shorter, contorted, and characteristically bifurcated at the apex, representing a typical case of preventive defensive action. The very small haustoria penetrating the epidermal cells underwent rapid degeneration in consequence of an immediate violent reaction on the part of the host, consisting in the release of specific toxins, either already present in its cytoplasm or, more probably, secreted at the moment of invasion, and in a process of phagocytosis by the host nucleus, accompanied by extensive chromatic changes in the latter. The rapid death and disintegration of the haustoria were followed by similar manifestations in the infected and adjacent host cells, appearing in the next three or four days in the form of small, brown, elongated spots in the epidermal layers and mesophyll of some of the leaves.

An indigenous variety of maize proved to be absolutely refractory to infection by *E. g. tritici*. Although the conidia germinated rather more abundantly than on wheat, there was no sign whatever of haustoria in the epidermal cells or even of necrotic spots at the site of inoculation.

Virgilio wheat exposed to continuous irradiation (*ca* 2,000 kW.) displayed the same type of preventive defence as oats [*R.A.M.*, xviii, p. 471]. However, the necrotic lesions developing on the latter host as a sequel to infection were absent on the former, indicating that the high degree of resistance acquired artificially by wheat through the action of light is not comparable with the congenital immunity of oats.

Lathbury (R. J.). **The development of Wheat varieties in Kenya.**—*Emp. J. exp. Agric.*, xv, 59, pp. 177–188, 1947.

All wheats in Kenya, irrespective of the altitude at which they are grown, should possess resistance to stem [black] rust (*Puccinia graminis*) and leaf [brown] rust [*P. triticina*] and to yellow rust (*P. glumarum*) at the higher altitudes (over 7,000 ft.). This paper outlines the progress of the diseases in the country since they first appeared, describes the discovery of fresh physiologic races of *P. graminis tritici*, and outlines the progress made in breeding for resistance to this disease. The seventh physiologic race, K 7 [cf. *R.A.M.*, xx, p. 560], was isolated in 1943 and has so far been found only in breeding cages although reported from the field in Tanganyika in 1945. Wheat is grown over most of the year, *P. graminis* seemingly maintaining itself through the uredospore stage. It is considered possible that wind-blown spores from Abyssinia might account for the presence of new races.

The Canadian wheats Regent RL 975.6 and Apex RL 1857, possessing mature plant resistance in Canada, are also resistant to most of the Kenya races of *P. graminis* in the seedling stage. Of the more recent crosses of importance No. 291 (Australian 26. A×58. F. (L. 1)) has several good qualities for medium altitudes up to 7,000 ft., and one strain bred from it (291. J 1. I 1) is resistant to all seven races of *P. graminis*; No. 294 (Australian 26. A×117. A), suitable for altitudes up to 8,000 ft., yields well and has produced several rust-resistant strains and No. 261 (Kabete hybrid×Reliance) has yielded some early-maturing strains which, though slightly susceptible to race K 7, produce grain of good quality and are particularly suited to the lower areas requiring quick-maturing wheats. In addition an early-maturing Kabete hybrid, No. 192. Q. 2. A. (L), of unknown origin, is useful in the lower areas for its resistance and good grain quality.

Rosen (H. R.). **Breeding Wheat to combine resistance to leaf rust, speckled leaf blotch, and glume blotch.**—*Phytopathology*, xxxvii, 7, pp. 524–527, 1947.

During the past decade or two the acreage of wheat in Arkansas has been reduced, largely through the prevalence of leaf [brown] rust (*Puccinia rubigo-vera* var. *tritici*) [*P. triticina*], speckled leaf blotch (*Septoria tritici*) [*R.A.M.*, xxiv, p. 281; xxv, pp. 155, 301], and glume blotch (*S. nodorum*) [ibid., xviii, p. 661]. In 1941 the breeding of wheat for resistance to these diseases was initiated, mainly with a view to winter pasturage and grain feed supplies. One of the wheats under investigation at the University Farm, Fayetteville, Fultz Sel.×Hungarian, C.I. 12017, showed less brown rust than any named variety, though nearly all the plants bore a few fairly large pustules (3 to 4 type) denoting a susceptible reaction. However, the occasional pustule-free individuals appeared not only resistant to *P. triticina* but were less affected by *S. tritici* and *S. nodorum* than the other varieties under cultivation.

Three successive series of selections from these plants culminated in 1946 in a higher and more uniform type of resistance to brown rust and glume blotch and somewhat greater resistance to speckled leaf blotch in the bulk of the progeny as compared with C.I. 12017. Thus, 25 out of 37 selections gave a lower and more uniform rust reading than the original. On 25th April, when Purplestraw and Sanford, used as controls, showed 35 to 50 per cent. infection by *P. triticina*, in none of the selections did the incidence exceed a trace. On 18th to 20th May, when 90 per cent. of the upper blades of the two varieties were occupied by brown rust pustules and the lower blades were dead, mostly through the combined action of speckled leaf blotch and brown rust, the maximum reading obtained on C.I. 12017 and its derivatives was 20 per cent. Comparative determinations by K. S. Chester of the reactions to eight race groups of brown rust [ibid., xxvi, p. 239] of selection 12017–24–2, C.I. 12017, and Sanford showed the first-named to be resistant to 6, 9,

12, 21, 45, and 65 and intermediate in response to 2 and 5; the parent was resistant to 6, 9, 12, and 65, intermediate to resistant to 21, intermediate to susceptible to 2 and 5, and showed confused reactions to 45; while Sanford was resistant to 12 and 45, susceptible to 5, 6, 9, 21, and 65, and gave conflicting responses to 2. Of particular interest in relation to future breeding work is the resistance of the soft red 12017–24–2 to the widely aggressive race group 21. The selections here described have not been investigated for their reactions to bunt [*Tilletia caries* and *T. foetida*], both of which are usually of minor importance in Arkansas.

A promising outlook for combined resistance to *P. triticina* and *S.* spp. is further offered by the cross (Red Rock × Hope) × C.I. 12017, the lines of which, however, are still segregating in the F_4.

Kristev (K. K.). Твърдата главня Пшеницата в България и създаване на сортове, устойчиви на тази болест. [Bunt of Wheat in Bulgaria and breeding of bunt-resistant varieties.]—*Annu. Univ. Sofia*, xxiv, 1, pp. 405–475, 2 figs., 1946. [English summary.]

Continuing his studies on wheat bunt in Bulgaria [*R.A.M.*, xvi, p. 305], the author describes the biology and distribution in Bulgaria of the causal fungi *Tilletia levis* [*T. foetida*] and *T. tritici* [*T. caries*]. The spores of the latter did not germinate in nutrient media. *T. foetida* is found throughout the country, while *T. caries* occurs in the Vidin and Belogradchik districts, in the surroundings of Stara-Planina, in the Botevgrad district, and in areas in north Bulgaria, in the Rousse district, and traces in the Sofia, Elhovo, and Varna districts.

Using 15 test wheat varieties, bunt originating from 45 sources was shown to be of two physiologic races of *T. foetida*. Race I severely infected Hussar, Relief, Martin, White Odessa, and Rex which were immune from, or resistant to, race II. The races also differed in physiological reactions (minimum temperature for development and change of colour produced in the media) and in morphological characters (length of the promycelium, size of the chlamydospores, and shortening of the stem of the infected plant). Race I occurs predominantly in western Bulgaria with the exception of two isolated areas in Karlovo and Rousse-Obrastzov Tchiflik, whereas race II is distributed throughout the north and south. Comparing the two races with those described in the literature, the author suggests that they are the same as races found in Germany and the United States. Tests showed that none of the Bulgarian wheat varieties was resistant to the two races, but Balvan 5 was highly resistant to race I. Of the foreign varieties tested, Hosar was fully immune and Ridit and Hope highly resistant to both races.

Popp (W.). **A rapid method of examining Wheat heads for bunt infection.**—*Phytopathology*, xxxvii, 6, pp. 418–420, 1 fig., 1947.

The simple, rapid, and accurate method in use at the Dominion Laboratory of Plant Pathology, Winnipeg, Canada, for the examination of wheat heads for bunt (*Tilletia caries* and *T. foetida*) is based on the observation that the disease is more conspicuous in a ripening stand immediately after drenching rain. The heads are first soaked in water, either overnight at or near boiling-point or with the addition of a wetting agent for 24 hours at room temperature, and inspected in a good light while still wet. The contrast in the infected heads before and after immersion is very marked, the bunt balls, which swell and turn much darker while soaking, usually being recognizable either through or between the now semi-transparent and extended glumes. Since hot water destroys the spores it should only be used when the material is not required for inoculation or a wetting agent is not available.

In a test in which 20 wheat varieties were inoculated separately with the two smuts, 10,147 of the total of 68,000 heads (14·9 per cent.) were graded as infected when examined in the dry state compared with 12,558 (18·5) inspected after immer-

sion. It was commonly found in certain varieties that only one or two kernels or occasionally part of a kernel in a head had contracted infection. Of 3,400 heads of Regent, one of the varieties affected in this way, bunt could be detected in only 34 (1 per cent.) when the heads, but not the individual spikelets, were examined dry, as against 100 (2·9) after immersion. In practice it has been found that up to 2,500 heads of wheat can be examined by one person in an hour using the method described.

Urion (E.) & Hanus (J.). **Malt and beer from Barley affected by smut.**—*Brasseur franc., 1947*, 5, pp. 7–9, 1947. [French. Abs. in *J. Inst. Brew.*, N.S., xliv, 4, p. 210, 1947.]

Barley samples from crops attacked by covered smut [*Ustilago hordei*] become thickly dusted with spores during threshing and subsequent handling, and the resultant greyish tinge would normally involve their rejection by maltsters. In periods of short supply of barley, however, such samples might be accepted, and an investigation was accordingly made to determine the possible effects on the beer of smut infection of the grain. Laboratory tests on batches from a heavily contaminated lot of 100 quintals [1 quintal = 100 kg.] showed that a dry brushing readily detached the bulk of the spores, as also did washing with water, which was turned grey. The entire sample was then cleaned and screened in the ordinary way, followed by steeping, the second and third liquors containing lime water. The finished malt was somewhat overgrown but not otherwise remarkable, and the flavour of the beer brewed from it was perfectly normal.

Livingston (J. E.). **Barley fertilizer and seed treatment test.**—*Phytopathology*, xxxvii, 6, pp. 426–428, 1947.

Test plots, 100 by 4 ft., were laid down in 1945 and 1946 to determine the combined effect of fertilizers and seed treatment on barley root rot of unknown origin, a severe outbreak of which in 1943 caused a heavy reduction in the Nebraska crop. In 1945 the experiments were conducted in Merrick County on sandy loam of low fertility, and in 1946 in Hall and Buffalo Counties on moderately fertile soil of the same type. The nitrogen-phosphorus-potassium soil amendments were applied in the following ratios: none, 0–30–0, 20–0–0, and 20–30–0, four replications of each being planted with certified Spartan barley treated with new improved ceresan ($\frac{1}{2}$ oz. per bush.) and four with untreated seed. In 1945 seed disinfection conferred no appreciable benefit except in combination with the nitrogen (uramon)-phosphorus (45 per cent. superphosphate) fertilizer, the joint treatment increasing the bushel yield per acre from 11·5 to 24. Even by itself the nitrogen-phosphorus amendment gave a high yield (19·2 bush. per acre). In 1946 nitrogen, both alone and combined with phosphorus, significantly augmented yields, with or without seed treatment, which by itself was ineffectual.

Cooper (W. E.). **Sclerospora macrospora on Oats in Louisiana.**—*Plant Dis. Reptr*, xxxi, 7, p. 270, 1947. [Mimeographed.]

Oats of the selection C.I. 4316 infected with *Sclerospora macrospora* [*R.A.M.*, xxiv, p. 14] were collected in late May, 1947, at Crowley, Louisiana, where the disease has not been reported previously. The symptoms, spore characteristics, and measurements closely agreed with those given by Miles and Epps [ibid., xxii, p. 62].

Leukel (R. W.) & Pollack (Flora G.). **Periconia circinata (Mangin) Sacc. as a possible causal factor in Milo disease.**—Abs. in *Phytopathology*, xxxvii, 6, p. 440, 1947.

Isolations from the roots of Colby milo [sorghum] grown in soil from [? Cali-

fornian] fields naturally infested with the agent of milo disease [*R.A.M.*, xxii, p. 101] frequently yielded a fungus with a dark mycelium producing either numerous conidia or thick-walled, catenulate chlamydospores, which was identified as *Periconia circinata* [ibid., xviii, p. 809]. Heavy inoculation with the organism in steamed soil caused severe injury to Dwarf Yellow and Colby, both susceptible to milo disease, but was without apparent effect on the resistant varieties. In less heavily inoculated soils susceptible plants were stunted, had small heads or none, and died considerably earlier than those of resistant varieties grown in the same plots. The susceptible plants were similar in many ways to those grown in soil naturally infested with the milo disease organism. *P. circinata* may, therefore, be a contributory factor to the disease.

Thirumalachar (M. J.) & Mundkur (B. B.). **Morphology and the mode of transmission of the Ragi smut.**—*Phytopathology*, xxxvii, 7, pp. 481–486, 2 figs., 1947.

Sections of very young, ovariicolous sori of the smut of *Eleusine coracana* caused by *Melanopsichium eleusinis* [*R.A.M.*, xxvi, p. 266], which is widespread in the Mysore, Bombay, and Madras Provinces, indicate that the fungus forms locular sori in lysigenous cavities. The sorus transforms the ovary into a gall six or seven times the normal size of the grain. The subglobose to spherical, yellowish-brown, verruculose spores, 7 to 11 (mean 9·6) μ are formed centripetally. They germinate readily, producing primary and secondary ovate to cylindrical, uninucleate, thin-walled, biguttulate sporidia, conjugation between which was not observed. The chlamydospores of *M. eleusinis* form small, white colonies on potato dextrose agar within three or four days. Mycelial production is scanty, but secondary sporidia develop rapidly.

The smut was shown by inoculation experiments not to be carried in or on the seed. The application to ears just emerging from the sheath of sporidial or chlamydospore suspensions resulted in some 13 per cent. contamination of the plants, indicating that floral infection occurs at an early stage and that the pathogen is probably air-borne.

Siegler (E. A.) & Childs (J. F. L.). **Isopropanol-soluble compounds in controlling stem-end decay of Oranges.**—*Phytopathology*, xxxvii, 6, pp. 399–402, 1947.

In a limited series of tests in Florida from April to July, 1946, the amount of stem-end rot of Valencia oranges (*Diplodia natalensis* and *Phomopsis* [*Diaporthe*] *citri*) [*R.A.M.*, xxv, p. 212 and next abstract] appearing after three weeks' storage at 70° F. was reduced from 45·9 to 4·3 and 2·5 per cent., respectively, by a 30-second pre-storage dip in either 5 per cent. diphenyl sulphoxide or 5 per cent. benzhydrol, both in 100 per cent. isopropanol. At 2·5 per cent. in 50 per cent. isopropanol, diphenyl sulphoxide and benzhydrol reduced the incidence of infection from 41·4 to 8·2 and 3·8 per cent., respectively. Even better results were given by two to five seconds' immersion of the fruits in 5 per cent. phenylurethane in 100 per cent. isopropanol, which reduced the amount of stem-end rot from 34 to 1 per cent. In another series, using the solvent at 50 per cent., the reduction effected by 5 per cent. phenylurethane was from 40·2 to 1·1 per cent. In a single test in which diphenyl sulphoxide, benzhydrol, and phenylurethane, all at 5 per cent., were incorporated in a light summer oil and applied to oranges by the dip method, the incidence of stem-end rot was reduced from 22 to 10·2, 11·1, and 2·4 per cent., respectively. The rind burn caused by diphenyl sulphoxide was of moderate extent and that due to benzhydrol rather severe, while phenylurethane was responsible only for slight burns where the oil had gathered at points of contact between fruits.

Hildebrand (E. M.). **Stem-end rot fungi attacking immature Citrus fruit.**—Abs. in *Phytopathology*, xxxvii, 6, p. 433, 1947.

Florida oranges, grapefruit, and tangerines were found to develop infection by the causal organisms of stem-end rot (*Phomopsis* [*Diaporthe*] *citri* and *Diplodia natalensis*) [*R.A.M.*, xxvi, p. 449 and preceding abstract] only on their removal from the trees, being open to contamination by the pathogens from shortly after the blossom phase until maturity. The percentage of immature fruits developing symptoms within a month of picking increased between June and October from 20 to 70 per cent. The initial symptoms were observed on occasional fruits within a week, while on others the rots were still developing 16 weeks after removal. Histological examination of the button region of fruits of all ages demonstrated the frequent presence of hyphae of spores of the pathogens around, on, and under the calyx lobe but never below the cork layer on attached fruits. After picking, however, the fungus rapidly spreads from the outer to the deeper button tissues and thence into the fruit.

Neal (D. C.). **Observations in 1945 and 1946 on the relationship of rainfall in Louisiana to the incidence of Fusarium wilt of Cotton.**—Abs. in *Phytopathology*, xxxvii, 6, p. 435, 1947.

The rainfall at Baton Rouge, Louisiana, from May to August, 1945, slightly exceeded the 20-year average with major departures from the normal in June and August. In 1946 the same average was greatly exceeded, with wide deviations from the normal in May and July and slighter ones in June. In both years maximum temperature ranges of 90° to 97° F. occurred during these months. In 1945 wilt (*Fusarium*) [*vasinfectum*: see next abstracts] appeared early (12th June) and became progressively more severe as the season advanced, resulting in crop failures in several susceptible cotton varieties. On the contrary, in 1946 the disease was only sporadic before mid-August, even on the more susceptible varieties. The precipitation and bi-weekly wilt infection data indicate that the incidence of the disease is increased by alternating wet and dry spells during the optimum period for infection, June to August, and by rainfall slightly in excess of the 20-year average, whereas heavy rains of lengthy duration at this time are adverse to its development [cf. *R.A.M.*, xviii, 106; xxvi, p. 105].

Young (V. H.). **Relation of environment to the incidence of Fusarium wilt of Cotton.**—Abs. in *Phytopathology*, xxxvii, 6, p. 437, 1947.

No correlation was established in 192 soil samples from 11 areas of Arkansas between the pH, ranging from 4·66 to 8·4, and cotton wilt [*Fusarium vasinfectum*]. The disease was severe on potash-deficient soils [*R.A.M.*, xxi, p. 74], which tend to acidity, but the latter did not appear to be the decisive factor. The use of boron-containing soil amendments did not reduce the incidence of infection. Eighteen years' records at the Cotton Branch Experiment Station, Marianna, showed that high rainfall, especially before August, was generally correlated with greater prevalence of wilt while, conversely, the disease was less prominent in years marked by long dry spells, notably in June and July [cf. preceding abstract]. Over the five-year period from 1929 to 1933 cotton was planted at fortnightly intervals from 15th April to 1st July, resulting in a 35 per cent. average of wilted plants for the former date and 3 per cent. for the latter. High soil moisture during more of the growing season is believed to be mainly responsible for the heavier infection in the earlier sowings.

Smith (A. L.) & Ballard (W. W.). **Wilt resistance in Empire Cotton.**—Abs. in *Phytopathology*, xxxvii, 6, pp. 436–437, 1947.

The original parent plant of Empire [*R.A.M.*, xxv, p. 333], a promising cotton

variety now in the third year of commercial production [in Georgia], was re-selected in 1935 from a field planting of Stoneville 2 first selected in 1931. A number of lines have been selfed continuously since 1938, and tests of these from 1944 to 1946, inclusive, revealed a wide range of reaction to wilt [*Fusarium vasinfectum*: see preceding abstracts], extending from high susceptibility to resistance on a par with that of the best commercial varieties. The heterozygosity of the original plant expressed in these variations suggests its probable derivation from a cross between Stoneville and a wilt-resistant variety. The uniformity of the selfed lines for agronomic characters facilitated an immediate shift in production to those with a high degree of resistance.

RAMAKRISHNAN (T. S.). **Studies in the genus Colletotrichum—III.**—*Proc. Indian Acad. Sci.*, Sect. B, xxv, 1, pp. 15–27, 1 pl., 1947.

In pursuance of his studies on the genus *Colletotrichum* at the Agricultural Research Institute, Coimbatore [*R.A.M.*, xxi, p. 162], the author investigated the physiology of French bean and oat agar cultures of *C. indicum*, using isolates from cotton supplied by J. F. Dastur [ibid., xiii, p. 507]. The optimum temperature for growth was found to be about 32° C. with a minimum of 10° and maximum of 37°. Maltose and sucrose were the best sources of carbon among those tested, while peptone provided an ample supply of nitrogen. Staling products accumulated in cultures over three weeks old, filtrates of which induce the wilting of cotton seedlings in 12 hours.

C. indicum was compared with *C. capsici* from chilli [ibid., xxi, p. 363], *C. curcumae* from *Curcuria longa* [loc. cit.], and isolates of *Colletotrichum* from *Cicer arietinum* (recorded by Sundararaman as a species of *Vermicularia* [ibid., vii, p. 678]) and *Aristolochia bracteata* [ibid., xxi, p. 363]. The growth of an isolate on the tissues of a particular host for a number of generations was shown to enhance its pathogenicity to the plant in question. Thus, after five passages through sterilized cotton seed the five isolates under investigation were able to infect cotton seedlings, though not all with equal virulence or at the same rate.

The taxonomic position of the several isolates is fully discussed, with references to the relevant literature, in the light of these results, and is found to call for revision. The author finds no basis for separation in their morphological characters or pathogenic proclivities and proposes their relegation to one species under the earliest name of *Colletotrichum capsici* according to the International Rules of Botanical Nomenclature.

SCHWEIZER (G.). **Über die Kultur von Empusa muscae Cohn und anderen Entomophthoraceen auf kalt sterilisierten Nährböden.** [On the culture of *Empusa muscae* Cohn and other Entomophthoraceae on cold-sterilized nutrient media.]—*Planta*, xxxv, 1–2, pp. 132–176, 18 figs., 1947.

A comprehensive account is given of the author's methods for the culture of the fly parasite, *Empusa muscae* [*R.A.M.*, xxiv, p. 504], and other Entomophthoraceae, which have hitherto failed to make satisfactory growth as saprophytes, in enzymatically active media, e.g., meat extract gelatine with an admixture of blood or serum and glucosamin (essential to chitin formation). On such substrata these entomogenous fungi flourish and complete their life-cycles, as in the natural hosts, with an abundance of fructifications, permitting of their large-scale cultivation for biological control purposes. The conidia are germinable, for three to five days only, immediately after discharge. The germination of the resting (azygo- and zygo-) spores requires a special biocatalytic stimulus, which may be simulated in the laboratory by means of pure cultures of chitin-splitting bacteria.

DRECHSLER (C.). **Three Zoopagaceous fungi that capture and consume soil-inhabiting rhizopods.**—*Mycologia*, xxxix, 3, pp. 253–281, 8 figs., 1947.

The morphology and behaviour are described of three new members of the Zoopagaceae [*R.A.M.*, xxv, p. 342]: *Stylopage rhabdoides*, *Acaulopage ischnospora*, and *A. crobylospora*, all of which consume soil-inhabiting amoebae found on decayed vegetable matter.

DRECHSLER (C.). **Three new species of Zoopage predaceous on terricolous rhizopods.**—*Mycologia*, xxxix, 4, pp. 379–408, 7 figs., 1947.

Three new members of the Zoopagaceae [see preceding abstract], isolated from decaying plant remains, are described, *Zoopage virgispora*, *Z. pachyblasta*, and *Z. toechospora*, which capture and consume soil rhizopods.

VANTERPOOL (T. C.). **Selenophoma linicola sp. nov. on Flax in Saskatchewan.**—*Mycologia*, xxxix, 3, pp. 341–348, 4 figs., 1 pl., 1947.

A fungus belonging to the genus *Selenophoma* was first collected from dead branches and pedicels of linseed flax in Saskatchewan in 1944. It was again collected in 1945 and pre-harvest surveys in 1946 showed light infestations of the same species extending from the limit of the flax-growing area in the north of the Province to the Estevan district near the southern boundary and from the South Saskatchewan River in the centre of the Province eastward to near the Manitoba boundary. The infection was much lighter in the north, probably owing to the delayed maturity of the crops. The rapidity with which the infestation has spread among the early maturing crops indicates that it may cause great damage in the future, although at present the disease is of no economic importance on flax. Artificial inoculations of flax seed with spore suspensions caused a slight inhibition of root growth accompanied by curling and an increase in branch roots, but the suspensions caused no infection of plants in the early stages of boll development. In the field pycnidia were mostly commonly found on the early maturing Redwing, on plants already affected by other diseases, such as physiological die-back, and on the pedicels of aborted bolls. It has also been found on several other named linseed varieties.

Although the fungus resembles *S. bromigena* [*R.A.M.*, xxiv, p. 316] in certain cultural characters the latter appears to be confined to *Bromus* spp. Cross-inoculations with the two species on certain flax and grass hosts yielded no infection. The two species differ also in spore size. *S. linicola* n. sp. is described as having mostly scattered, raised pycnidia in zones 3 to 20 mm. long, usually encircling the fine branches and pedicels of flax, subepidermal, dark brown to black, flattened to globose, and measuring 110 to 140 by 85 to 110 (average 131 by 92) μ. The ostiole, about 11 by 23 μ, expands to twice this size in water after spore discharge. The pycnidiospores are unicellular, hyaline, usually vacuolate, lunate to falcate, typically 17 to 22 by 2·7 to 3 μ from natural material but larger in culture; germination is usually preceded by septation, especially on nutrient media.

SCHUSTER (M. L.) & ANDERSON (E. J.). **Seedling blight and root rot of Flax in Washington.**—*Phytopathology*, xxxvii, 7, pp. 466–473, 3 figs., 1947.

This is an amplified, tabulated account of investigations in Washington on flax seedling blight and root rot, a preliminary note on which has already appeared [*R.A.M.*, xxiv, p. 268]. *Fusarium oxysporum* was found to be the principal agent of seedling disease, having been isolated from 159 of the experimental specimens, while only eight yielded *F. solani*. The former species reduced emergence from 89 to 27 per cent. and caused pink to red, later brown, irregular root and stem lesions in 70 per cent. of the survivors. The corresponding percentages for *F. solani* were 85 and 18. The typical symptoms of the wilt due to *F. o.* f. *lini* (*F. lini*) did not develop in the susceptible Punjab variety as a result of inoculation

with *F. oxysporum*. The percentage of cracked seed in the variety Rio was 42. Seed threshed by hand gave better results in field and greenhouse tests than seed threshed by machine at medium cylinder speed, while that at high cylinder speed gave the poorest stand.

Jehle (R. A.) & Jenkins (Anna E.). **Diseases with scab-like symptoms observed in southern California in 1946.**—Abs. in *Phytopathology*, xxxvii, 6, pp. 439–440, 1947.

During November and December, 1946, symptoms resembling those of violet scab (*Sphaceloma violae*) [*R.A.M.*, xxvi, p. 153] were prevalent and destructive on English ivy (*Hedera helix*), *Pelargonium peltatum*, and *Schinus molle*, the two latter being extensively defoliated. The *H. helix* disease was identified as English ivy scab (*Sphaceloma hederae*) [ibid., xxvi, p. 217]. The symptoms on *P. peltatum* are reminiscent of the intumescences described on the same host by Ringuelet in 1927, as well as of oedema reported by F. C. Stewart in 1910, while (?) *Macrosporium pelargonii* [ibid., xvi, p. 537] was also present, apparently in a non-pathogenic form. The foliar lesions on *Schinus molle* are suggestive of *Sphaceloma* infection.

Cronshey (J. F. H.) & Dillon Weston (W. A. R.). **A disease of Gypsophila elegans.**—*Gdnrs' Chron.*, Ser. 3, cxxii, 3168, p. 108, 1947.

This paper indicates that the disease caused by *Sclerotinia serica* on *Gypsophila elegans* [*R.A.M.*, xvi, p. 679] is seasonal in its attack and can be avoided by spring sowing. On the occasion of the first report in 1933 [loc. cit.] the crop had been sown in September, the main localized attack occurring in November. In a September sowing in another part of the same field in 1934 the disease recurred in October to November and was so severe that the crop had to be abandoned. The same strip, left unploughed, was cultivated and re-sown in the spring of 1935. A successful crop without disease was obtained. Spring sowing was then continued in most years on various strips, no disease appearing on any of the crops. From 1941 to 1943 no *Gypsophila* was grown on the field but in 1944 and 1945 two spring sowings, some 50 yards distant from the site of the previous attacks, were successful. Autumn sowing was resumed in September, 1945, on two strips adjacent to and partly overlapping those of the 1944–5 spring crops. By November, 1945, one of these was severely attacked, the other only moderately. Upon examination it was found that sclerotia were being formed abundantly in the top soil near the attacked plants and surface mycelium was conspicuous on the soil around them, and along the leaves and stems of weeds where these occurred. It was noted that the spread of the disease became very slow after January and ceased by the end of March, and by late April the surface mycelium could no longer be seen. The following year a heavily contaminated strip with drills coinciding with those of the previous autumn was sown at the end of March. No disease was observed in the crop. A small block of soil which had been lifted from the field in November, 1945, did not produce any apothecia until September, 1946. Although spring sowing practically ensures *Gypsophila* crops free from *S. serica* it cannot be recommended as a general measure as such crops miss the early market.

Orlando (A.) & Silberschmidt (K.). **Estudos sôbre a disseminação natural do virus da 'clorose infecciosa' das Malváceas (Abutilon virus 1. Baur) e a sua relação com o inseto-vetor 'Bemisia tabaci (Genn.)' (Homoptera-Aleyrodidae).** [Studies on the natural dissemination of the virus of 'infectious chlorosis' of the Malvaceae (*Abutilon* virus 1. Baur) and its relation with the insect vector *Bemisia tabaci* (Genn.) (Homoptera-Aleyrodidae).]—*Arq. Inst. biol., S. Paulo*, xvii, pp. 1–36, 2 diags., 1946. [English summary.]

In order to study the natural dissemination of *Abutilon* virus 1 [*Abutilon* variega-

tion virus] among plants of *Sida rhombifolia* [*R.A.M.*, xxvi, p. 256], 1,096 healthy seedlings were set out on 18th to 19th November, 1943, in four beds, in two of which rows of infected plants alternated with sound ones, while in the other two the diseased specimens were placed along one of the borders. On 16th March, 1944, only 86 (7·87 per cent.) of the plants were still healthy, whereas all those from the same sample kept in an insect-proof greenhouse were virus free on the 28th.

Three healthy *S. rhombifolia* seedlings in pots, isolated from each other and from the soil by standing on pots inverted in dishes of water covered with Paris green, developed infectious chlorosis. This led to the conclusion that the insect vector of the virus was a winged form. Negative results had been obtained in an earlier series of experiments by four methods in the transmission of the *Abutilon* variegation virus by 21 insects. In the course of these trials one of the cages containing a mixture of healthy and diseased *S. rhombifolia* was found to be infested by white flies, subsequently identified as *Bemisia tabaci*, and incipient symptoms of infectious chlorosis were observed on some of the originally sound plants. Further experiments were accordingly conducted, using first- and second-generation adults of *B. tabaci* descended from specimens collected in the cage or field and bred on diseased plants, on 29 plants of *S. rhombifolia* and 25 of *A. striatum* var. *spurium*, of which all the former and 18 (72 per cent.) of the latter contracted infection. In another series, in which the white flies were introduced into cages of mixed healthy and diseased plants, 30 out of 44 (68·18 per cent.) *S. rhombifolia* and 22 out of 27 (81·48 per cent.) *A. striatum* var. *spurium* developed infectious chlorosis. The period elapsing between the infestation of the plants by *B. tabaci* and the initial symptoms of the disease ranged from 5 to 28 days in *S. rhombifolia* and from 12 to 45 in *A. striatum* var. *spurium*. A single individual of either sex sufficed, the female, however, with 10 out of 23 *S. rhombifolia* plants (43·48 per cent.) contracting infection, being more efficient for this purpose than the male (4 out of 20 or 20 per cent.).

Using five insects (male and female) per plant, infections were secured in 14 out of 17 plants (82·35 per cent.), while all 17 exposed to infestation by ten individuals of both sexes became diseased.

The probable geographical limits of the area of natural dissemination of infectious chlorosis are outlined in relation to the spontaneous occurrence of wild Malvaceae and to the existence of *B. tabaci* in the same region.

Tompkins (C. M.) & Tucker (C. M.). **Leaf blight of Pink Calla caused by Phytophthora erythroseptica.**—*Phytopathology*, xxxvii, 6, pp. 382–389, 2 figs., 1947.

Since 1938 a destructive leaf blight of the Superba calla (*Zantedeschia rehmanii*) has been prevalent in the Monterey Bay region of California. Symptoms of the disease include distortion, rapid wilting, chlorosis, and collapse of the leaves, with a soft, wet, brownish-black rot of the petioles at and slightly above and below soil-level, death of the foliage ensuing in a few days. The roots and corms are not attacked. On the basis of morphological characters and temperature-growth relations (minimum, optimum, and maximum for mycelial development, 13°, 25°, and 28° C., respectively), the fungus isolated on malt extract agar from the infected leaves was identified as *Phytophthora erythroseptica* [*R.A.M.*, x, p. 755]. The pink calla strain failed to induce the typical pink rot of potato tubers [ibid., xx, p. 32; xxiv, p. 285] but was pathogenic to its own host and yellow calla (*Z. elliottiana*) in soil inoculation tests, the incubation period averaging 25½ days. A footnote records the isolation of *P. erythroseptica* from diseased white calla (*Z. aethiopica*) in the San Francisco area. Wet, poorly drained soil and cool, foggy weather are predisposing factors in the development of the foliar blight, control of which should be effected by means of crop rotation and sanitation. This is believed to be the first record of *P. erythroseptica* as a parasite of pink calla.

Ciccarone (A.). **La coltivazione del Piretro nel Kenya.** [Pyrethrum cultivation in Kenya.]—Reprinted from *Riv. Agric. subtrop. trop.*, xl, 7–12, 21 pp., 1 diag., 1946.

In the section of this paper dealing with diseases of pyrethrum [*Chrysanthemum cinerariaefolium*: *R.A.M.*, xxvi, pp. 233, 454] in Kenya the author states that seedling rot due to *Pythium* sp. sometimes occurs. It is favoured by over-thick planting. The affected seedlings rot at the collar and lie along the ground but appear to remain healthy above the infected zone for a few days, presenting the appearance of plants that have been badly sprayed. As the host makes slow growth, infection spreads readily. The author obtained moderately good control by applying weak solutions of copper sulphate to the soil, but in practice the simplest method is to remove and burn all infected material, reduce shade, and space out the crop.

Physiological wilt is sometimes due to improper cultural methods and the affected plants may be attacked later by various fungi. There is also, however, a parasitic wilt, which in the field is often confused with other diseases. The collar region is usually disintegrated, the cortical tissues showing an abundant hyaline, septate mycelium. The base of the petiole of the lowest leaf may show a discoloured, somewhat striped area a few centimetres long. Hendrickx informed the author orally that in the higher regions of the Belgian Congo wilted pyrethrum plants yielded *Fusarium javanicum* var. *radicicola* [ibid., xiii, p. 397], the same fungus also having been observed on this host by Hopkins (*in litt.*); but in Kenya of 14 lines of *Fusarium* isolated from wilted pyrethrum by the author, while some were referable to the section *Martiella*, none resembled *F. j.* var. *radicicola*. On several occasions *Sclerotinia minor* [ibid., xix, p. 71] was isolated from infected pyrethrum material and soil.

Failure in the few attempts made at pyrethrum cultivation in [former] Italian East Africa was also associated with a wilt, apparently due to *Fusarium* spp.

Under favourable conditions of humidity and temperature the flower heads and rays develop dark spots due to *Alternaria gossypina* [ibid., xxvi, p. 14]. Infection sometimes follows infestation by *Thrips tabaci*.

Saravi Cisneros (R.). **Enfermedades de los bulbos de Gladiolo en almacenamiento.** [Storage diseases of *Gladiolus* corms.]—*Anu. rur. B. Aires*, xiv, pp. 209–311, 3 figs., 1946.

Some of the rots affecting stored *Gladiolus* corms in Argentina originate during the growing period and continue to develop in the warehouse. Of these the only one so far investigated in the country is the hard rot caused by *Septoria gladioli* [*R.A.M.*, xxvi, p. 340]. Storage decays proper include the dry rots due to *Penicillium* (?) *gladioli*, *Fusarium* (?) *oxysporum* var. *gladioli* [ibid., xxvi, p. 402], and a species of *Botrytis* [cf. ibid., xxvi, p. 58] the systematic position of which is still uncertain.

Wilson (C.). **Anthracnose on Blue Lupins.**—*Plant Dis. Reptr*, xxxi, 7, pp. 270–271, 1947. [Mimeographed.]

In southern Alabama cultivated blue lupins (*Lupinus angustifolius*) have been severely attacked by anthracnose (*Colletotrichum* sp.) [*R.A.M.*, xxii, p. 299]. Plants approaching maturity suffered the greatest damage; some fields showed as much as 100 per cent. infection and 90 per cent. of the seed was destroyed. Developing seed pods were most susceptible, but all aerial portions of the plants were attacked. The first symptoms on the pods were small, more or less circular, sunken, black spots, which enlarged rapidly and coalesced, covering the pods with pinkish or salmon acervuli, typical of bean anthracnose [*C. lindemuthianum*]. Seeds within diseased pods were often infected and shrivelled. The hyaline, non-

septate, usually straight spores, with rounded ends, were approximately 6 by 17·5 μ. Brown, unbranched setae about 70 μ long were fairly numerous.

JACKOBS (J. A.). **Factors affecting seed rotting caused by Pythium spp. in Sweet-clover with preliminary tests in Alfalfa and Red Clover.**—*J. Amer. Soc. Agron.*, xxxix, 8, pp. 702–718, 1 diag., 2 graphs, 1947.

The percentage of viable, scarified seeds emerging as seedlings varied among seed lots of sweet clover (*Melilotus alba* and *M. officinalis*) planted in the greenhouse and field at the Wisconsin Agricultural Experiment Station in 1944 and 1945. Lucerne and red clover were included in some of the tests. The rate of emergence was not influenced by soil temperatures within the range of 7° to 22° C. or by the position of the seeds in the flat. Isolates from rotted sweet clover seed included *Pythium debaryanum*, *P. ultimum* (both of which were proved to be pathogenic), possibly other *P.* spp., and species of *Rhizoctonia*, *Fusarium*, and *Mucor*. After the seeds had been planted for 72 hours in *Pythium*-infested soil they could be placed in two classes, in one of which rotting took place before the hypocotyl began to elongate, while in the other it had elongated to at least ½ cm. The lack of gradations between the two groups suggests that seed-rotting is independent of subsequent invasion of the hypocotyl as it occurs in damping-off. Further evidence in support of this view is afforded by the absence of association between the percentages of emergence and of seedlings showing post-emergence damping-off.

Viable immature seeds are more likely to decay than genetically comparable mature ones. A rupture of the seed coat near the hilum is less likely to favour fungal contamination than cracks in other places.

Inherent differences were observed among the plants in respect of the incidence of seed decay in their progenies. They are probably attributable to the mature plant characters influencing seed development rather than to genetic factors for resistance or susceptibility to *P.* spp. in the germinating seeds.

BLAIR (I. D.). **Ryegrass blind seed disease.**—*Agric. Bull. Canterbury Coll., N.Z.*, 210, 4 pp., 2 figs., 1947.

This bulletin gives a brief general account of perennial rye grass (*Lolium perenne*) blind seed disease caused by *Phialea temulenta* [*R.A.M.*, xxvi, p. 231]. The life-cycle of infection, procedure of seed examination, and control measures (resistant strains, crop management, and seed treatment) are described.

An increase of the disease among the now dominant, susceptible true perennials has occurred. Hundreds of rye grass samples from South Island districts have been examined at Lincoln College for pre-harvest infection. During 1944–5 the number of samples showing 0 to 10, 10 to 20, 20 to 30, 30 to 50, 50 to 70, and 70 to 100 per cent. infection were 3, 13, 15, 32, 15, and 22, respectively, the corresponding numbers for 1945–6 in the same categories being 35, 20, 15, 10, 10, and 10, respectively.

The control measures recommended include the planting of rye grass seed crops at some distance from old fields and surrounding them with arable crops, seed storage for two years, and hot-water seed treatment [ibid., xxiii, p. 228].

MILLS (W. D.). **Effects of sprays of lime sulphur and of elemental sulphur on Apple in relation to yield.**—*Mem. Cornell agric. Exp. Sta.* 273, 38 pp., 4 graphs, 1947.

The author summarizes the results of other workers on the effects of sulphur sprays on the growth and yield of apple trees. From these and his own results he concludes that the occurrence of leaf scorch is an accepted fact; its possible subsequent effects on the yield, size, and quality of the fruit are discussed. The increase of the midsummer fruit drop [*R.A.M.*, xx, p. 104] caused by lime-sulphur is far less common in most apple-growing areas than is leaf scorch. Under some con-

ditions this fruit drop tends to increase size by early thinning, whereas size is often reduced by severe foliage injury. The growth rate of young leaves is temporarily retarded by sulphur applications, even by elemental sulphurs, while with lime-sulphur the retardation is much greater. Pre-harvest drop [ibid., xxi, 529] of McIntosh apples may be increased by lime-sulphur in summer sprays. Increase in winter injury to the lower limbs resulted from severe leaf injury by lime-sulphur the previous summer.

Observations are recorded of the effects of several fungicidal programmes over a five-year period from 1933 to 1937 on an orchard of vigorous McIntosh apple trees, individual tree yields of which were available for the three previous years (1930–2) when they received a uniform lime-sulphur schedule. Under this schedule the three-year average yield was taken to indicate the individual yielding capacity of the trees and during the following years the effects of the various fungicides were expressed as deviations in yield under a given treatment from this three-year average of the same tree. Any possible differences due to tree size were avoided by using these deviations expressed in bushels per tree. In the first, fourth, and fifth years trees given flotation sulphur used throughout the season showed a significant increase in yield over those receiving lime-sulphur and also (in the first and fifth years) over those receiving the latter for the calyx spray followed by flotation sulphur or dry-mix sulphur lime. In average yield for the five-year period, flotation sulphur throughout the season gave a significant increase of 135 bushels per acre per year over trees receiving lime-sulphur for all sprays.

Commercial scab [*Venturia inaequalis*] control was obtained with all four schedules used, the increased yield of scab-free fruit obtained by using elemental sulphur sprays instead of lime-sulphur being approximately the same as the increase in total yield. Control of scald and russet were equally effective except in 1936.

English (H.). **Powdery mildew on Cherry fruit in Washington.**—*Phytopathology*, xxxvii, 6, pp. 421–424, 1 fig., 1947.

In the summer of 1944 *Podosphaera oxyacanthae* was found infecting sweet cherries harvested from orchards near Wenatchee, Washington, this being apparently the first record of the pathogen on the fruits in the United States, though it has long been known to attack the leaves and shoots. The invaded areas are circular, or more often irregular, due to the coalescence of two or more infections. A thin white mantle of hyphae, radiating from the centre of young lesions, covers the diseased portions and robs them of their lustre. The injured areas become somewhat sunken and the fruits definitely mis-shapen. The older lesions are reddish-brown and the texture of the skin is abnormally tough. Prior to a heavy thunder shower on the evening of 19th July, followed by 1½ days of hot, humid weather, no powdery mildew had been observed on the fruits, but on 21st heavy infection was noted in some of the orchards and on fruit delivered at the packing-house.

The trees in the most severely affected orchard were rather closely planted. The succulent shoots and leaves in the interior of trees with heavy fruit infection invariably sustained extensive damage. The presence of ripe perithecia on the leaves pointed to a fairly early date for the onset of shoot infection, probably during the alternating hot and showery periods about mid-June and the beginning of July. The development of *P. oxyacanthae* on the cherries may also have been influenced by the occurrence of the fungus on neighbouring chokecherries (*Prunus demissa*) [*P. virginiana*]. In the most severely infected orchard, the Bing variety suffered much heavier damage than Lambert or Napoleon. Black Tartarians were reported by fruit inspectors to show the worst damage in the packing-houses.

In storage tests at 40° and 65° F. at a relative humidity of about 85 per cent. no evidence was obtained of any increase in size of the mildew lesions, nor were

new infections observed on any of the fruits apparently sound when stored. At 40° and 65°, slightly more decay developed in mildewed than in sound fruit, but as it amounted to less than 4 per cent. even in the most severely affected sample, susceptibility to storage rots does not appear to be materially increased.

During the dry summer of 1945 the same orchards were scarcely affected by mildew.

Noble (M[ary]) & Gray (E[lizabeth] G.). **Two interesting fungi.**—*Gdnrs' Chron.*, Ser. 3, cxxii, 3166, p. 92, 3 figs., 1947.

The first record in the British Isles of *Puccinia ribis* on red currants was reported by Plowright (*Gdnrs' Chron.*, xvi, p. 135, 1894) from specimens from Dallas, Morayshire. In the autumn of 1946, a specimen of this fungus was received from Mr. Murray of the North of Scotland College of Agriculture, who collected it at Coulmony, near Dava, Morayshire. The garden in which it was found contained some very old, severely infected bushes, from which the disease spread to young bushes near by. In June, 1947, the rust reappeared on the old bushes. In the early stage of infection the leaves show dark green spots, the centres of which become dark purple-black as the spores develop, and a yellow halo appears. The very early appearance of the disease bears out the view that the mycelium of the fungus overwinters in the buds. The bushes at Coulmony are so old that they may be contemporary with the original ones which no longer remain at Dallas. The two instances described in this paper are the only known British records.

Hapalosphaeria deformans [*R.A.M.*, xxii, p. 318] was found on blackberries for the first time in the British Isles at Aberlady, East Lothian, in 1922 and was described by Dr. M. Wilson (*Trans. Brit. mycol. Soc.*, vii, p. 84, 1922). The fungus was found again in 1947 in East Lothian, Midlothian, Perthshire, and the suburbs of Edinburgh, and the authors conclude that the fungus is common on wild blackberries in these districts, though it has not been observed yet on cultivated plants or other species of *Rubus*.

Demaree (J. B.). **A proliferating gall on Blueberry plants caused by an Actinomyces.**—Abs. in *Phytopathology*, xxxvii, 6, p. 438, 1947.

The fungus responsible for tumefactions, often accompanied by bud proliferation, at or near the primary node of blueberry (*Vaccinium*) plants [? in Maryland] has been tentatively identified as an *Actinomyces*. The swellings, which commonly attain enormous dimensions in relation to the infected stem, give rise to numerous, mostly abortive buds; a few, however, may differentiate into short, fleshy shoots with abnormal foliage, or several buds may develop into spindly shoots with small leaves, culminating in a growth of the witches' broom type. Young plants readily contracted infection when fragments of agar containing hyphae and spores were applied to wounded tissues near the primary node. The pathogen was reisolated from the plants thus infected and served as inoculum in its turn. The original isolations came from spontaneous galls on young blueberries cultivated in soil composed partly of leaf mould from a forest floor where huckleberries (*Gaylussacia baccata*) grew, many of them affected by an undetermined witches' broom. Among several different lots of seedling blueberries totalling over 1,700, the incidence of natural infection per lot ranged from 8 to 70 (average 26) per cent.

Cass Smith (W. P.) & Stewart (Miss [R.]). **Leaf spot disease of Black Mulberry.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xxiv, 1, pp. 69–74, 3 figs., 1947.

The fungal leaf spot disease of black mulberry (*Septogloeum mori*) [*R.A.M.*, xvi, p. 785], first recorded in Western Australia in 1943, spread so rapidly during the 1945–6 and 1946–7 seasons that it now affects practically all areas of the State where mulberries are grown. Although they are of little economic importance

compared with other fruits, mulberries are very easily grown and are therefore valuable as a source of fresh fruit. The fungus appears to be confined to the leaves upon which dark spots, 1 to 2 mm. in diameter, surrounded by light green or yellow tissue, appear early in the growing season. These spots enlarge, the centre turning white with numerous very small, black pustules developing on the surface of the lesions. In humid weather the pustules become raised and pinkish. The leaf spots may reach 10 mm. or more in diameter, with dark brown margins and whitish centres. Browning of the veins occurs near the necrotic area. The coloured areas round the spots may coalesce and eventually cause severe defoliation. If the tree is thus weakened early in the season premature fruit drop occurs.

The black pustules or acervuli consist of a flat stroma from which arise the conidiophores and conidia which are elongate, thin-walled, and colourless with two to three septa. The conidia become exposed as a pinkish, upraised mass and are disseminated by wind and rain from leaf to leaf. In autumn when the vigour of the leaves declines, dark, thick-walled, 1- to 9-septate spores are formed. In cool and wet conditions the conidia germinate and reinfect the leaves through the stomata on the lower surface, causing new leaf spots from which fresh spores arise. After dry periods in summer the disease becomes active again with the arrival of the rains. The thick-walled spores in infected leaves held over winter and exposed to natural climatic conditions were more than 80 per cent. viable in spring as determined by pathogenicity tests.

So far, Bordeaux mixture and lime-sulphur applied during the growing season have proved capable of controlling an epidemic. The following four measures are recommended for controlling the disease: (*a*) destroy all fallen leaves in autumn, (*b*) as the buds begin to swell in spring spray the trees with lime-sulphur at 1–15 or Bordeaux at 6–4–40, followed a fortnight later by (*c*) a second spray at 1–50 or 3–4–40, respectively, (*d*) if dry weather follows the first spray the second may be unnecessary, but in wet weather a third with lime-sulphur at 1–100 or Bordeaux at 2–4–40 should be applied after the fruit is set.

Bitancourt (A. A.) & Jenkins (Anna E.). **A verrugose da Mangueira.** [Mango scab.]—*Arq. Inst. biol., S. Paulo*, xvii, pp. 205–228, 3 pl., 1946. [English summary.]

This is an expanded account of the authors' studies on specimens of mango scab from Cuba, Florida, Puerto Rico, and the Canal Zone [*R.A.M.*, xxii, p. 216]. The ascomata of the causal organism, *Elsinoe mangiferae* n. sp., are pulvinate, intra-epidermal, 80 to 160 by 30 to 48 μ, with a pseudoparenchymatous, hyaline matrix. The scattered, globose asci are 10 to 15 μ in diameter and contain one to eight hyaline, triseptate ascospores, 10 to 13 by 4 to 6 μ. The perfect state was collected only in Cuba. The conidiophores of *Sphaceloma mangiferae* are erect, slightly sinuous, 12 to 35 by 2·5 to 3·5 μ, and the elongated, brownish, continuous or uniseptate, catenulate conidia measure 6 to 29 by 2 to 4 μ. This probably represents the imperfect state of *E. mangiferae,* but definite evidence of a genetic connexion is not yet forthcoming.

Material of a similar disease collected in São Paulo, Brazil [loc. cit.], yielded perithecia measuring 38 to 55 by 15 μ and globose asci, 12 μ in diameter, containing up to eight hyaline, triseptate, straight or slightly curved ascospores, 10 to 12 by 3 to 4 μ. No fructifications of the imperfect state were observed. The Brazilian fungus developed most profusely at 21° C. and the Cuban at 27°, the latter also making appreciable growth at 35°, whereas 31° was the maximum for the former. Inoculation experiments on young mango foliage were successful with the Cuban but not with Brazilian isolate. It is concluded from those studies that the two pathogens are distinct, and that the Brazilian disease should be classed as an anthracnose rather than as a scab [ibid., xii, p. 596].

Das Gupta (S. N.) & Rai (J. N.). **Wilt disease of Guava (Psidium guajava L.).**—*Curr. Sci.*, xvi, 8, pp. 256–258, 2 graphs, 1947.

In order to investigate a destructive wilt of guavas occurring at Lucknow and in other districts of the United Provinces, trees of the Government Horticultural Garden were kept under careful observation during the years 1945 and 1946. The highest rate of wilting occurred during the rainy season, the disease starting in August (four trees attacked) and increasing sharply in September (15) and October (10) when the most deaths occurred. In November there was a marked decrease in the number of infected trees (six to seven) and with the advancing winter the disease came almost to a standstill. The symptoms are a yellowing and drying of the leaves of terminal branches, the complete wilting of the tree taking 10 to 15 days. Some of the finer roots showed black streaks which became more prominent on removing the bark, while others were uniformly black. Isolations from the root system and the lower part of the diseased trees yielded a *Fusarium* sp. Inoculation tests were made with potted plants one month, three months, one year, and three years old, to the soil of which the *Fusarium* culture was added. The percentages of wilted plants of the different ages were 86·3, 100, 83, and 80, respectively; no wilting occurred in the controls. The fungus was reisolated from the roots of the wilted plants. Grown in Richards's solution it produces some toxic substance which causes wilt in the guavas. Seedlings transferred to these solutions die readily. In a filtered 20-day-old culture solution the first wilt symptom in one-year-old seedlings was observed after three hours, and within 10 to 12 the plants died. Further studies of the mechanism and physiology of wilt are in progress and a detailed paper is expected to be published shortly.

Seín (F.) & Adsuar (J.). **Transmission of the bunchy top disease of Papaya (Carica papaya L.) by the leafhopper Empoasca papayae Oman.**—*Science*, cvi, 2745, p. 130, 1947.

The authors report further successful transmissions of papaw bunchy top disease [*R.A.M.*, xxvi, p. 458] by leafhoppers now definitely identified as *Empoasca papayae* [ibid., xxv, p. 305] and confirmed by P. W. Oman. Out of 30 healthy plants whose upper parts were enclosed in cellophane casings, and on each of which five to ten male insects collected from diseased plants were released, nine developed bunchy top symptoms in about 90 days. Thirty control plants excluded from leafhoppers remained healthy.

Horsfall (J. O.). **Naming of synthetic fungicides.**—*Plant Dis. Reptr*, xxxi, 7, p. 268, 1947. [Mimeographed.]

Dr. D. Powell of the University of Illinois has agreed to set up a sub-committee of the general Committee on Fungicides of the American Phytopathological Society in order to study the problem of common names of synthetic chemicals and fungicides [*R.A.M.*, xxvi, p. 459]. The author suggests that the Society should delegate to its Fungicide Committee, working in collaboration with the entomologists, the authority to choose common names and recommend their adoption.

Khristov (A.). Фитопатология. [Phytopathology.]—608 pp., 73 figs., Sofia, Published for the University Students' Aid Fund in Bulgaria, No. 128, 1947. [Mimeographed.]

This book contains abbreviated records of lectures on plant diseases given at the Sofia State University during 1946–7, and is divided into two sections, I [pp. 16–119] non-infectious diseases caused by chemical factors (soil deficiency and excess nutrients) and weather conditions, II [pp. 120–607] infectious diseases (virus

diseases [pp. 120–187], bacterial [pp. 188–245], fungal [pp. 246–586], and those due to higher plants [pp. 587–601]).

PRESLEY (J. T.). **A host index of Mississippi plant diseases.**—*Plant Dis. Reptr, Suppl.* 169, pp. 55–168, 1947. [Mimeographed.]

This first contribution towards a host index of plant diseases in Mississippi contains all the available information on their occurrence and distribution in the State. It consists of three sections, each arranged alphabetically: a list of hosts (under the Latin names), with all the pathogens known to occur on each, an index of pathogens, each accompanied by the Latin names of the hosts on which it has been recorded, and an index of the common names of the hosts.

SNYDER (W. C.) & HANSEN (H. N.). **Advantages of natural media and environments in the culture of fungi.**—*Phytopathology*, xxxvii, 6, pp. 420–421, 1947.

One of the natural media found effective both for the sporulation and isolation of certain fungi is a fumigated chopped pea straw in water agar [*R.A.M.*, xxvi, p. 461]. Cultured on this substratum the hyphae of *Mycosphaerella pinodes* and *Ascochyta pinodella* develop a profusion of typical dark chlamydospores around and on the fragments of straw, while pycnidia may be found on the agar surface. Plates of pea-straw agar may be taken into the field where surveys are to be made and even the underground parts of the plants may be placed directly on the medium after removal of the adhering soil. Specific identification of *A. pinodella* and *M. pinodes* can usually be effected in a week by this method. *Verticillium albo-atrum* also grows readily on pea-straw agar, the hyphae producing an abundance of microsclerotia on and around the fragments of straw, while typical conidiophores and conidia develop on the surface of the agar. No preliminary sterilization of the infected tissues is required, nor do laboratory contaminants appreciably interfere with the recovery of the fungus. Other fungi easily isolated from gross cultures on pea-straw agar include *Phytophthora*, *Pythium*, and *Rhizoctonia* spp., *Alternaria solani*, and a species of *Gloeosporium*, of which the two last-named sporulated abundantly. Perithecia of *M. pinodes* are produced in large numbers on the straw in a wheat straw plus agar medium.

Other examples are adduced to illustrate the influence of natural surroundings on the development of fungi. Thus, *Centrospora* [*Ansatospora*] *acerina* [ibid., xxiv, p. 305] sporulates copiously on agar media outside but not inside a north window, as also do the imperfect states of *Botryosphaeria ribis* and *M. brassicicola* [cf. ibid., xxvi, p. 152].

COOPER (P. S.). **Plant injections for diagnostic and curative purposes.**—*E. Afr. agric. J.*, xiii, 1, pp. 37–53, 4 diags., 1947.

A description is given of the use of a hypodermic syringe for plant injections in the diagnosis of mineral deficiencies [*R.A.M.*, xxiv, p. 334; xxvi, p. 342], a technique requiring only patience and experience with relatively little technical skill in order to obtain rapid and accurate results. The advantages and disadvantages of using the syringe are discussed, the two most useful types are described, and a list is given of the additional equipment required. The veinal, leaf tissues, and stem injection methods are described and their application to individual plants is discussed, the type and strength of the chemical solutions used are given, and the effect of chemical and mechanical damage is assessed. The length of time which elapses between injection and the appearance of symptoms is shown to vary with the type and age of plant, the element being injected, and the atmospheric temperature. The symptoms attributed to deficiencies of some of the major and minor elements are briefly outlined, and a short note is given regarding tablet injection methods [ibid., xxiv, p. 334].

The results of tests in England [? and Uganda] show that the injection of nitrogen (ammonium, calcium, or potassium nitrate) into plants suffering from nitrogen deficiency by all three methods resulted in the renewal of the normal green colour of the injected leaf in a few hours. When deficient field cabbages were inoculated it was possible to confirm a nitrogen deficiency after 24 hours and complete recovery resulted in 36. Injections of dicalcium phosphate resulted in renewal of the green colour after three to six days. Barley plants suffering from severe phosphate deficiency did not recover until four days after injection. Potash deficiency has been successfully diagnosed and the normal leaf colour renewed in three to five days in a wide variety of plants in the early stages of deficiency. Injections with calcium nitrate took about the same time, coffee seedlings recovering completely ten days after injection. Injections with magnesium sulphate produced the return of normal colour within six to seven days. Slightly affected greenhouse tomato plants recovered in five days [cf. ibid., xxvi, p. 185]. Injections of acid ferrous (iron) sulphate by the leaf veinal and stem methods into deficient greenhouse tomato plants gave renewed colour in 36 hours. Manganese sulphate injections renewed the healthy colour in citrus leaves in eight to nine days and corrected grey speck [manganese deficiency] of oats if injected while the streaks were still in the grey state. Leaves of the groundnut injected with zinc sulphate became noticeably greener after five days, this being the first recorded case of zinc being essential to groundnuts under field conditions. The leaves of zinc-deficient maize plants recovered their greenness about three days after injection. Injections with boric acid into young boron-deficient sugar beet caused recovery of the distorted crown leaves and the production of new healthy growth. Cassava cuttings infected with cassava mosaic virus [ibid., xxvi, p. 281] were injected at intervals of 10 days with a 5 per cent. solution of 8-hydroxy-quinoline potassium sulphate, and all the leaves recovered eight days after the fourth injection.

Georg (Lucille K.). **A simple and rapid method for obtaining monospore cultures of fungi.**—*Mycologia*, xxxix, 3, pp. 368–371, 1 fig., 1 diag., 1947.

In order to isolate single spores [*R.A.M.*, xxv, p. 406] 2 to 3 μ or larger, a small conical glass tip can be made from a length of glass tubing; the larger end should fit round the lens of the low-power objective (6 to 7 mm.) and the smaller should approximate the microscopic field as seen through the lens (1·5 to 1·8 mm.). The tube is heated to redness and drawn out to the required shape. A thin ring of plasticine is fitted round the lens of the low-power objective and to this the sterile conical tip is fixed. The spore is centred in the microscopic field, and the objective lowered so that the small end of the tip cuts a disk of agar containing the spore. This disk is then removed by a sterilized needle.

Ciccarone (A.). **Verde iodio ed eritrosina nella differenziazione di parassiti fungini in tessuti legnosi.** [Iodine green and erythrosin for the differentiation of fungal parasites in woody tissues.]—*Nuovo G. bot. ital.*, N.S., liii, 1–2, p. 358, 1946.

In a study of *Monochaetia unicornis* in relation to a woody canker of *Cupressus macrocarpa* [*R.A.M.*, xxv, p. 86], in which difficulty had been experienced in differentiating the mycelium from the disintegrated gummy tissues of the host, good results were obtained from the following treatment, the host tissues turning green and the parasite violaceous-red. The material was placed in a 1 per cent. aqueous solution of iodine green for 5 to 15 minutes, washed in water (this may be omitted), placed in 95 per cent. alcohol followed by absolute alcohol, then, for 8 to 15 minutes or more in erythrosin in 1 per cent. clove oil, cleared in clove oil, and then taken through absolute alcohol and xylol to balsam. The same method also proved satisfactory with *Pestalozzia* [*Pestalotia*] *funerea*, also on *C. macrocarpa*.

Kavanagh (F.). **Estimation of antibacterial substances by serial dilution methods.**—*Bull. Torrey bot. Cl.*, lxxiv, 4, pp. 303–320, 1947.

This study deals with several modifications of serial dilution methods suitable for quantitative measurement of concentrations of anti-bacterial substances [*R.A.M.*, xxvi, p. 206]. Descriptions are given of the selection of bacteria and media, the identification of the substances by their anti-bacterial activity, and the manipulative details and results of three modifications of the geometric-series dilution test and one of the arithmetic-series. The errors occurring in the dilution tests are also discussed.

Robbins (W. J.), Kavanagh (F.), & Hervey (Annette). **Antibiotic substances from Basidiomycetes. I. Pleurotus griseus.**—*Proc. nat. Acad. Sci., Wash.*, xxxiii, 6, pp. 171–176, 1947.

During laboratory studies on Basidiomycetes producing substances that inhibited the growth of *Staphylococcus aureus* [*R.A.M.*, xxvi, p. 258], *Pleurotus griseus* seemed particularly worthy of further investigation. The results showed that *P. griseus* produces a substance differing from all other antibiotic substances that have been prepared in pure form. The best medium for *P. griseus* was found to be beech shavings in modified Czapek-Dox solution to which dextrose and maize steep solids were added. The method of isolation and properties of the antibiotic substance named pleurotin are described. It is active only against Gram-positive bacteria. The instability and low solubility of pleurotin in aqueous solution indicate that it is unlikely to have any therapeutic value.

Robbins (W. J.), Kavanagh (F.), & Hervey (Annette). **Antibiotics from Basidiomycetes. II. Polyporus biformis.**—*Proc. nat. Acad. Sci., Wash.*, xxxiii, 6, pp. 176–182, 1947.

The further investigation of *Polyporus biformis* [*R.A.M.*, xxvi, p. 258] showed that it produces two antibiotic substances in culture liquids, to which the names biformin and biforminic acid have been given. These substances inhibit a number of Gram-negative, Gram-positive, and acid-fast bacteria.

Rudert (F. J.), Kenner (B. A.), & Foter (M. J.). **The assay of antibiotic mixtures.**—*J. Bact.*, liii, 1, pp. 57–60, 1947.

These studies were undertaken to devise plate assays suitable for the determination of single components in the following mixtures: penicillin-streptomycin, gliotoxin-streptomycin, and gliotoxin-penicillin. The following procedures were used to separate the components. Treatment with 0·01 *M* potassium periodate destroyed streptomycin but the gliotoxin remained unaffected. Extraction by chloroform removed the gliotoxin, but streptomycin and penicillin were retained in the water layer. Penicillin was inactivated by a 10 per cent. volume of penicillinase solution containing 200 penicillinase units per ml. Penicillin could be assayed in the presence of 10 parts of streptomycin by using *Staphylococcus aureus* FDA 209P. Various known inactivators of streptomycin were used in an effort to find a selective agent but all destroyed penicillin to a certain degree.

The assays were made on nutrient agar by the filter paper disk method and the methods are adaptable to mixtures containing widely different proportions of antibiotics, with the exception of penicillin in the presence of streptomycin where the assayable proportions depend on the sensitivity of the *S. aureus* strain used.

Penicillin: its properties, uses, and preparations.—viii+199 pp., 9 figs., 5 diags., 2 graphs, London. The Pharmaceutical Press, 17 Bloomsbury Square, W.C. 1, 1946. 10*s.* 6*d.*

The first chapter of this handbook, published by direction of the Council of the Pharmaceutical Society of Great Britain, is an historical summary of the discovery

and development of pencillin. The remaining chapters deal with (II) commercial manufacture, (III) chemistry and chemical properties, (IV) stability, (V) standard, unit, and methods of assay, (VI) pharmacology, (VII) clinical use, (VIII) pharmacy and pharmaceutical preparations, and (IX) legal considerations. A bibliography of 331 titles is appended.

Winsten (W. A.) & Spark (A. H.). **Penicillin types produced by P. chrysogenum Q-176.**—*Science*, cvi, 2748, pp. 192–193, 2 figs., 1947.

Tests with *P*[*enicillium*] *chrysogenum* Q-176 grown on maize steep liquor-lactose medium showed that it can produce at least eight penicillins [*R.A.M.*, xxvi, p. 164]. These include G (benzylpenicillin), F (Δ^2-pentenylpenicillin), what is probably dihydro-F (*n*-amylpenicillin), K (*n*-heptylpenicillin), and X (*p*-hydroxybenzylpenicillin). The new types S-1, S-2, and S-3, which were produced in small quantities, have not as yet been specified chemically. A modification of Goodall and Levi's method (*Nature, Lond.*, clviii, pp. 675–676, 1946) was used in determining the types of penicillin present.

Verona (O.). **Influenza di liquidi colturali fungini sullo sviluppo dei microbi del suolo.** [The influence of fungal cultural liquids on the development of soil micro-organisms.]—*Ann. Fac. agr. Pisa*, N.S., vii, pp. 147–156, 1946.

To ascertain the effect produced by filtrates from the cultures of various fungi upon soil micro-organisms, an experiment was carried out in which filtrates from cultures of *Aspergillus* sp., *Chaetomium globosum*, *C.* sp., *Stachybotrys atra* [*R.A.M.*, xviii, p. 696; xxiv, p. 389], *Stemphylium botryosum* [*Pleospora herbarum*], *Alternaria tenuis*, *Fusarium* sp., *Rhizopus nigricans* [*R. stolonifer*], and *Mucor mucedo* were mixed in various proportions with saccharose-bean agar and added to Petri dishes containing 0·1 c.c. of a mixture of soil in water (1 in 1,000). After three days at 24° C. it was found that the agar without addition of culture filtrates showed 496 colonies of micro-organisms. The agar with the *Aspergillus* filtrate (1, 2·5, and 5 per cent. additions) showed, respectively (average of three determinations), 28, 16, and 4 colonies. The corresponding figures for *Chaetomium* sp. were 9, 4, and no result, for *C. globosum* 190, 75, and 24; and similar reductions were obtained with all the filtrates except *Fusarium* sp. and *Stachybotrys atra*. When the experiment was repeated using a different method of culturing the fungi, the results were confirmed. A third experiment was then carried out, using retorts each with 250 c.c. nutrient broth, to some of which 5 per cent. of culture filtrate of either *Aspergillus* sp. or *Chaetomium* sp. was added. All the retorts were then sown with 0·5 c.c. of the 1:1,000 soil–water mixture and kept at 24° for five days. The numbers of micro-organisms present in 1 c.c. of the culture liquid after one day were 270,000 for the control, 12,000 for *Aspergillus* sp., and 65,000 for *Chaetomium* sp., the corresponding figures for three days being 7,410,000, 93,400, and 70,300, and for five days over 7,410,000, 182,620, and 398,500 (average of three determinations in each case). In the fourth experiment the culture filtrates from *Aspergillus* sp. and *Chaetomium* sp. were used (*a*) after boiling for ten minutes and (*b*) after mixing with soil. After three days at 24° the controls showed 740 colonies. The boiled *Aspergillus* filtrate (25 and 5 per cent.) gave, respectively, 110 and 97, and that mixed with soil 520 and 643; the boiled *Chaetomium* filtrate gave 270 and 29 and that mixed with soil 881 and 540. From this it is concluded that the culture extracts were thermostable with respect to their antibiotic activity, but that the substances possessing the antibiotic activity were largely retained by the soil. Evidence was obtained that the filtrates of *Aspergillus* sp. and *Chaetomium* sp. slowly exercised a dissociative effect on colonies of *Bacterium coli* and *Bact. tumefaciens*.

Scofield (F.). **Methods of mildew tests.**—*Paint Indust. Mag.*, lxi, pp. 176–177, 1946. [Abs. in *Brit. Chem. Abstr.*, B II, December, p. 467, 1946.]

In Florida the best conditions for exterior field tests for the resistance of paints to mildew [*R.A.M.*, xxvi, p. 503] are provided by a site near a grove of trees; vertical exposure to prevent confusion with dirt collection; north exposure; the spring months; and panels painted and dried on the exposed site. Since the principal infection occurs before the film hardens, the tests need only run sufficiently long for the spores to germinate, i.e., three to four weeks. Brief observations are made on the testing of interior paints.

Nagy (R.). **Ultraviolet lamps to control fungi.**—*Food Indust.*, xix, 7, pp. 102–103, 5 figs., 1947.

Pure cultures of a number of food moulds were exposed to measured amounts of ultra-violet radiation [*R.A.M.*, xxiii, p. 266 and next abstract] (Westinghouse Electric Corporation) and allowed to incubate for 48 hours with the following results, expressed in the number of 'clicks' of energy (one 'click' = 220 microwatt seconds per sq. cm.) requisite for the destruction of the organisms: *Penicillium roquefortii* 120, *P. expansum* 100, *P. digitatum* 400, *Aspergillus niger* 1,500, *A. flavus* 450, *A. glaucus* 400, *Rhizopus nigricans* [*R. stolonifer*] 1,000, *Mucor racemosus* A and B 160, and *Oospora lactis* 50. It will be noted that pigment acts as a protective mechanism; the darker the colour of the spores, the more radiation is necessary to kill them.

Ohart (T. C.). **Germicidal lamps improve food plant sanitation.**—*Food Packer*, xxviii, 9, pp. 30–32, 4 figs., 1947.

Directions are given for the installation of G(eneral)-E(lectric) germicidal lamps, emitting ultra-violet wave-lengths in the region of 2,537 Å, in food plants for the control of bacteria and moulds [see preceding abstract], with special reference to the meat industry.

Agarwal (P. N.), Singh (K.), King (P. S.), & Peterson (W. H.). **Yields and vitamin content of food yeasts grown on different kinds of molasses.**—*Arch. Biochem., N.Y.*, xiv, 1–2, pp. 105–115, 1947.

At the Wisconsin Agricultural Experiment Station four food yeasts, namely, *Saccharomyces cerevisiae*, *Torula* [*Torulopsis*] *utilis* [*R.A.M.*, xxvi, p. 207], *Candida arborea*, and *Oidium* [*Oospora*] *lactis*, were grown on four kinds of molasses (Lansing, Mason City, and Ovid beets, and Hawaiian cane). Yields ranging from 44 to 65 per cent. based on the sugar supplied were obtained. Some 90 per cent. of the sugar was fermented. The reinforcement of the medium with nutrients, e.g., phosphate, urea, and maize steep liquor, was essential for the production of maximum yields. The protein contents of the yeasts ranged from 31 to 69 per cent. and their thiamin, riboflavin, niacin, and folic acid values from 20 to 40, 40 to 69, 192 to 600, and 6 to 22 γ per gm. dry yeast, respectively. As sources of protein and B vitamins *S. cerevisiae*, *T. utilis*, and *C. arborea* are about equally effective, while *O. lactis* is distinctly inferior.

Johnson (J.). **Water-congestion and fungus parasitism.**—*Phytopathology*, xxxvii, 6, pp. 403–417, 2 figs., 1947.

Water congestion may be induced experimentally in many plant species under favourable moist-chamber conditions [*R.A.M.*, xxv, p. 237]. Greenhouse-grown seedlings should be exposed to an outdoor environment in a sandy or sandy-loam soil low in potash for five to ten days before transference to the moist chamber. At the Wisconsin Agricultural Experiment Station marked intervarietal differences

in the rate and extent of visible water congestion were observed, sometimes even involving individual plants of the same variety.

Water-congested plants of a given variety were shown by inoculation experiments to be more susceptible to representative fungal pathogens, especially when grown in the open, than non-congested, e.g., Bountiful, Black Wax, and Great Northern beans (*Phaseolus vulgaris*) to anthracnose (*Colletotrichum lindemuthianum*), Marquis wheat to stem [black] rust (*Puccinia graminis*), States Pride and Vicland oats to leaf [crown] rust (*P. coronata*), Golden Bantam and Golden Glow maize to rust (*P. sorghi*) [*P. maydis*], and Marglobe tomato to late blight (*Phytophthora infestans*). No visible signs of water congestion appeared in potato and sunflower in these studies, but both indoor- and outdoor-grown plants of the former host developed late blight (*P. infestans*) and those of the latter rust (*Puccinia helianthi*) in the inoculation tests, presumably associated with a macroscopically imperceptible degree of congestion. Susceptible varieties developed water congestion more easily than resistant varieties.

Drechsler (C.). **Germination of oospores of Pythium butleri and Pythium tardicrescens.**—Abs. in *Phytopathology*, xxxvii, 6, pp. 438–439, 1947.

Transferred to a shallow layer of distilled water, oospores of *Pythium butleri* [*P. aphanidermatum*] from 60-day-old maize meal agar cultures germinated freely by the production of zoospores. The process was commonly preceded by the resorption of the thick inner wall layer, while the protoplasm assumes an appearance closely resembling that of the sporangium of *P. debaryanum*. On discharge into a vesicle at the apex of a simple or occasionally branched evacuation tube, averaging 40 to 225 by 2·5 to 5 μ, the contents are converted into about ten motile zoospores. A similar mode of germination was observed in the oospores from a 112-day-old culture of *P. tardicrescens* [*R.A.M.*, xxiii, p. 441], isolated from a blackened *Bidens* root at Arlington, Virginia, in October, 1943, the tube in this species measuring 60 to 350 by 2 to 3 μ. After discharge the persistent outer oospore wall in both species sometimes encloses a separate sporangial envelope.

Baribeau (B.). **Possibilités d'amélioration, d'organisation et d'extension de la production des Pommes de terre de semence.** [Possibilities of improving, organizing, and extending the production of seed Potatoes.]—Reprinted from *Agriculture*, [? *Quebec*], iv, 1, 19 pp., 7 figs., 1 graph, 1 map, 1947.

After stating that in the northern and north-eastern regions of Quebec potato degeneration due to virus diseases progresses much more slowly than in the warmer south and south-west [*R.A.M.*, xxvi, p. 209], the author describes a study, based on the results given by the tuber-index method [ibid., xxvi, p. 414], of the suitability for seed-potato growing of different areas of the Province. The evidence obtained showed that the spread of potato virus diseases depends on proximity to the sea, isolation, altitude, aspect, climatic conditions, prevalence of insect vectors, and the presence of certain trees and shrubs. Even in areas least favourable to virus diseases it is essential to maintain the usual precautions, and even to renew the seed from time to time.

In the Province as a whole there is a shortage of seed potatoes of good quality. The average yield of culinary potatoes from 1942 to 1946 was only 120 minots per acre [1 minot = 39 l.], though the yield of certified seed potatoes for the same period was 237 minots per acre. The low figure of 120 minots is due to the fact that for 90 per cent. of the total potato area (160,000 acres) the seed used was of variable and often very inferior sanitary quality. The total requirement of seed potatoes for Quebec as a whole probably reaches over 2,000,000 minots. The present (1946) minimum requirement of good-quality seed amounts to over 500,000 minots. To meet this there are (1946) 8,000 to 12,000 minots of Foundation seed, 180,000

minots, at most, of Foundation A seed, and perhaps 100,000 minots of satisfactory Certified seed. It is obvious that every area suitable for seed potato production must be organized so as to produce in 1947 the greatest possible quantity of good seed. The possibilities of new districts can be estimated by the isolated tuber method and the tuber index method.

LITTLEJOHN (L. J. S.). **Experiments with Potatoes in Cyprus.**—*Emp. J. exp. Agric.*, xv, 59, pp. 195–205, 1947.

In this paper there is an illuminating paragraph demonstrating with the aid of tables the seriousness of 'degeneration' in Cyprus and the need for general 'seed' certification [*R.A.M.*, xxv, p. 464] and inspection. During the years 1939 to 1945 the average potato yield was falling owing to the increasing amounts of various virus complexes being distributed through the stocks. When a comparison was made between once-grown tubers and those grown seven or eight times, both lifted in June, 1944, and kept in cold storage, the yields obtained in 1945 were 120 and 37·3 cwt. per acre, respectively. The commonest acute symptom of virus attack is leaf-drop streak [potato virus Y: ibid., i, p. 250 *et passim*], which can be almost fatal, especially to Up-to-Date.

In 1944 a local potato seed certification scheme based on field inspection of the growing crop was started in order to offset the shortage of imported seed. Seed older than 'twice-grown' is not inspected. According to the results of tests of certified seed in 1945, inspection and certification can do much to raise the general level of potato yields. The use of locally certified once-grown seed for the second (autumn) crop and locally certified twice-grown seed for that part of the first crop not planted with imported seed would considerably increase average yields. The use of certified seed is increasing especially in villages where the dormancy is broken by some form of treatment [ibid., xxvi, p. 212].

MILLS (W. R.). **Blight-immune Potato varieties show good qualities in regional trials.**—*Bull. Pa St. Coll.* 480, *Suppl.* 3, pp. 3–4, 3 figs., 1947.

In the 1946 potato-yield trials at the Pennsylvania State College Experiment Station in which no fungicides were applied and no blight [*Phytophthora infestans*: *R.A.M.*, xxvi, p. 506] appeared on the resistant varieties, 34 of the latter exceeded 500 bush. per acre and 17 of these yielded over 600, the highest figure being 806 compared with 250 to 300 bush. from the susceptible varieties. The results show that a good blight-resistant variety may be grown at a considerably lower cost per acre than a good susceptible variety.

CALLBECK (L. C.). **Killing Potato tops with chemicals.**—*Proc. Potato Sect. Ont. Crop Improvement Ass., 1947*, pp. 11–20, 1947.

The perfect chemical potato-top killer should be inexpensive, should kill effectively and rapidly, and should be non-injurious to crop, soil, and workers. With these points in mind several chemicals [*R.A.M.*, xxvi, pp. 78, 463] were tested at the Charlottetown Laboratory during 1946. Of those which most nearly fulfilled the conditions, calcium cyanamide was apparently most effective during warm, humid weather. Sodium arsenite or handy killer, used quite considerably in eastern Canada and the New England States at 1 qt. per 40 gals., is very slow in action when the plants are growing vigorously, the kill being accomplished in three to five days. Handy killer is, therefore, not suitable for virus control work but would be useful in autumn for herbicidal work when the plants are senescent. The main factors contributing to its popularity are its cheapness and simplicity of preparation. Sinox (2 gals. in 100) plus 8 to 10 lb. ammonium sulphate has given satisfactory results, a complete kill taking about three days. Two pints of sinox general [loc. cit.] with 4 gals. oil per 80 gals. spray as emulsifier gave a very rapid and

complete kill after three days. Dowspray 66 improved (dinitro ortho secondary butyl phenol in oil, used at 2 gals. in 100), placed in the market in 1946, and sinox general (2 pts. in 80) plus 2 gals. fuel oil produced the most rapid kills in 1946 and reduced tuber discoloration [see next abstract] after four months' storage to a minimum.

Richardson (J. K.). **Tests with Potato vine killers in Ontario.**—*Proc. Potato Sect. Ont. Crop Improvement Ass., 1947*, pp. 21–23, 1947.

Two preliminary tests were conducted [in 1946], one at Brantford on a field of Chippewa potatoes using three herbicides and another at St. Catherines with eight. At Brantford all three herbicides (sinox general, dow 66, and krenite+ammonium sulphate) [see preceding abstract] caused a rapid kill, the effects becoming apparent a few hours after the application and death ensuing two days later. These same materials produced the same rapid results at St. Catherines, the others being much slower. Tubers left in the ground at Brantford for an extra three weeks had less vascular discoloration if the tops had been killed with dow 66 or sinox general than those killed with krenite+ammonium sulphate. At St. Catherines, although on the contrary the rapid killers produced slightly more injury than the slower ones, none produced more than a slight amount of discoloration. From these tests and information gained from other sources vascular discoloration produced by chemical vine-killers appears similar to injury from severe frost or leaf roll virus infection but does not seem to affect the growing qualities of the tubers, it is reduced by boiling and does not affect the edible qualities of the potatoes, and varieties seem to differ in their susceptibility to the condition. Observations made by various investigators indicate that the age of the plants, rapidity of kill, and the environmental conditions both prior and subsequent to top-killing may have a bearing on the severity of vascular necrosis in the tubers.

Wilson (A. R.), Boyd (A. E. W.), Mitchell (J. G.), & Greaves (W. S.). **Potato haulm destruction with special reference to the use of tar acid compounds.**—*Ann. appl. Biol.*, xxxiv, 1, pp. 1–33, 2 graphs, 1947.

In this investigation to find a non-corrosive spray for destroying potato haulms [see preceding abstracts] only those tar acids proving both effective and relatively harmless to the human skin were passed as suitable. At present compounds suitable for commercial production have been obtained only from the vertical-retort and low-temperature processes. High-boiling fractions (250° to 290° C.) usually fulfilled these conditions better than low-boiling fractions (190° to 250°). A tenacious rain-resistant emulsifier consisting of a mixture of gum arabic (1 per cent.) and casein (0·5 per cent.) was developed, yielding a stable concentrate easy to dilute with water of any hardness. Rainfall shortly after application considerably reduced the action of sulphuric acid, but in spite of this and other disadvantages it remains the best all-round herbicide. Sodium chlorate gave a fair leaf-kill but poor stem-kill and is therefore less effective than sulphuric acid, while calcium cyanamide dust was less efficient than sodium chlorate. Tar oil winter wash was effective but is expensive and slow-acting.

The extent of haulm-kill obtained directly influenced the control of blight [*Phytophthora infestans*] in the tubers. The fungus, unless actually wetted by the spray, continues to sporulate freely on the leaves until the tissues are dead. Therefore the quick-acting compounds, such as sulphuric acid and tar acids, give much better control than the slower ones. As haulm-killing accentuates the 'setting' of the tuber skin if the kill is virtually complete, maximum resistance to lifting injury is obtained by leaving the crop in the ground as long as possible after spraying. Skin-'setting' was assessed by rubbing sharply the skin of washed and dried tubers

three times in succession with the ball of the thumb. Skin-breaking at the first rub was graded 0, at the second 1, at the third 2, and no break 3. The use of tar derivatives and other compounds had no deleterious effect on the cooking quality of the tubers or on the soil.

T.A.C. 36 c [*R.A.M.*, xxvi, p. 463] plus the emulsifier and T.A.C. 42 also with emulsifier gave equally good results in a restricted field trial and are regarded as satisfactory for commercial use, which must be restricted because of high prices. Comparative costs are given for the more effective compounds. It is concluded that certain tar-acid sprays are the most effective non-corrosive substitutes for sulphuric acid on vigorous haulms. For killing senescent haulms some of the less effective and cheaper compounds such as sodium chlorate or copper sulphate and salt may prove reasonably satisfactory in most years.

Berkeley (G. H.), Thompson (R. W.), & Richardson (J. K.). **Five county Potato spray and dust project.**—*Proc. Potato Sect. Ont. Crop Improvement Ass., 1947*, pp. 82–84, 1 fig., 1947.

The results of the 1945 potato spraying and dusting experiments at Strathroy have already been reported [*R.A.M.*, xxvi, p. 212]. In 1946 the experiment was located near Brantford and was enlarged to 200 plots consisting of 40 different treatments replicated five times, using 20 different fungicides with DDT included in all sprays and dusts. There was no blight [*Phytophthora infestans*], but the yield data show that dithane was again superior to Bordeaux, plots sprayed with Bordeaux and phygon giving the lowest yields.

Parks (D. L.). **A Potato dusting and spraying experiment in eastern Ontario.**—*Proc. Potato Sect. Ont. Crop Improvement Ass., 1947*, pp. 85–89, 3 figs. (1 on p. 84), 1947.

An experiment conducted during 1946 at the Kemptville Agricultural School to test the effect of various fungicides against both early [*Alternaria solani*] and late blight [*Phytophthora infestans*: see preceding abstract] of potatoes was undertaken with the co-operation of the Crops, Seeds, and Weeds Branch of the Ontario Department of Agriculture. *A. solani* first appeared about 23rd July after a week of rainy weather, but *P. infestans* was absent. Although most treatments gave effective control of *A. solani* it continued to spread. The four treatments giving the highest yields were fermate 1½–1–100, naugazate (zinc dimethyl dithiocarbamate) 1½–1–100, copper-lime dust 12–85–3, and zerlate 1½–1–100, used with DDT. The potato vines of the plots sprayed with the organic fungicides fermate, zerlate, naugazate, and dithane were undamaged by the frosts which killed more than 90 per cent. of the tops on the other plots in the field. The unfrozen plants remained green for an extra month. Copper-lime dust with DDT effectively controlled early blight throughout the season.

Higinbotham (N.). **Some trace element deficiencies in Rice.**—Abs. in *Proc. Ind. Acad. Sci.*, lv, p. 37, 1945. [Received September, 1947.]

Nutrient solution experiments with rice indicate that it may be added to the list of plants requiring boron, manganese, and copper. Boron deficiency symptoms are distinctive, though resembling those due to a shortage of calcium in the chlorotic spotting of the leaves as they emerge at the tip. The first sign of manganese deficiency is a chlorosis of the mid-vein leaf areas resulting in striation of the young foliage. Plants deprived of copper showed no characteristic symptoms, but their weight was reduced in comparison with the controls. Supplementary experiments with boron demonstrated its indispensability for normal grain production; its utilization in the plant was shown to be related to the calcium supply.

Plant (W.). **Survey of mineral deficiencies on tillage land.**—*Nature, Lond.*, clx, 4062, p. 336, 1947.

By applying the visual diagnosis and tissue tests [*R.A.M.*, xxvi, p. 467] for determining the nutrient condition of crops statistics of practical value to the soil chemist and agriculturist have been obtained. Two seasonal surveys employing the first method were carried out in Herefordshire during 1945 and in Somerset during 1946, in each of which a random sample of farms was taken to represent two per cent. of all holdings of ten acres or more. From May to October each farm was visited two or three times, cereals, beans, potatoes, sugar beet, roots, and kale being inspected. It was found that nitrogen deficiency affected most crops, 18 per cent. of the acreage in Somerset and 10 per cent. in Herefordshire, especially where the level of husbandry was low. Phosphate deficiency (19 and 20 per cent., respectively) was particularly prevalent in the case of cereals; potash deficiency (1 per cent. in both counties) mainly confined to potatoes, also affected some mangolds, and calcium deficiency was found only in roots in Herefordshire and was negligible. Boron was the only trace element apparently lacking; sugar beet and mangolds in Herefordshire only were deficient.

Schmidt (Catherine M.), Jameson (Dorothy H.), & Specht (Virginia G.). **Bibliography of literature on potash as a plant nutrient reviewed September 1940 through December 1940. (With Index.)**—82+xxv pp., American Potash Institute, Inc., Washington, D.C., 1947. [Mimeographed.]

This annotated bibliography of the literature of potash as a plant nutrient covers only works reviewed from September to December, 1940, inclusive. The 275 items are arranged in three sections, the first under crops alphabetically, the second under potash (application, availability, deficiency, etc.), and the third under soils (soil absorption, soil losses, soil supply, etc.), each section being arranged alphabetically according to the locality. An index is provided to authors, subjects, and titles.

Hughes (C. G.). **The varietal revolution in the Ingham District.**—*Proc. Qd Soc. Sug. Cane Technol., 1947*, pp. 103–106, 1 graph, 1947.

During the past two years great prominence has been given to the performances of two new sugar-cane varieties, Trojan and Eros, in the Herbert River district round Ingham, North Queensland. Both canes were produced by the Colonial Sugar Refining Company in 1933. In 1944 Trojan gave 37 per cent. of the crop and Eros over 6 per cent. In 1945 the figures were 67 and 10 per cent., respectively, and in 1946, 74·7 and 16·7. The change of varieties was a direct result of gumming disease [*Xanthomonas vasculorum*: *R.A.M.*, xxvi, p. 262].

Hughes (C. G.). **The symptoms of leaf scald disease in Sugar-Cane.**—*Proc. Qd Soc. Sug. Cane Technol., 1947*, pp. 115–118, 1947.

A description is given of the symptoms of sugar-cane leaf scald [*Xanthomonas albilineans*: *R.A.M.*, vi, p. 121; xxvi, p. 263] as seen in Queensland, covering both the chronic and acute forms. In North Queensland the disease is usually present on the wetter, richer soils, but Badila is comparatively resistant; S.J. 4 is more susceptible, but remains moderately clean since the affected stools usually die. The two new canes, Trojan and Q 44, are susceptible.

Volp (P.). **The ineffectiveness of roguing leaf scald infected fields for use as a source of planting material.**—*Proc. Qd Soc. Sug. Cane Technol., 1947*, pp. 99–101, 1947.

In an attempt to rogue sugar-cane stools affected by leaf scald [*Xanthomonas albilineans*: see preceding abstract] from fields to be used as a source of planting material the author inspected chosen fields of Q 44 in the wettest parts of the

Mulgrave area of Queensland at least three times during growth. All stools showing signs of leaf scald were chopped down before the plant cutters commenced operations. Normal disinfection of the knives was carried out. Five sections in the wetter districts were rogued in May and two more in August, the selected blocks being those which, it was considered, would yield suitable planting material. In addition, two second ratoon blocks were selected from which affected stools had been rogued in previous years.

In the plant fields rogued the diseased stools destroyed ranged from 0 to 16, while in the two ratoon blocks 17 and 78 stools were destroyed.

Inspection of the planted fields one to two months after germination showed the presence of leaf scald in all the blocks planted from the rogued cane, though no symptoms had been visible at planting. The percentage of infected stools ranged from 0·01 to 2 in the fields planted from plant cane and from 2 to 6 in those planted from ratoon material. Infection subsequently increased.

The evidence suggests that the roguing of moderately susceptible varieties gives no assurance of clean stock when the varieties are infected and conditions favour growth. As a means of controlling leaf scald, roguing should be regarded only as a last resort in an attempt to keep infection in subsequent plantings within reasonable bounds. The periodical introduction of clean seed to an affected farm in a wet area at somewhat long intervals is also not a successful control measure, since considerable natural spread appears to occur at some stage of the plant's growth. The sole effective means of control appears to lie in the introduction of clean seed for every planting made on an infected farm, and in no circumstances should any cane from such a farm be used for planting.

De Charmoy (D. D'E.). **Une maladie nouvelle de la Canne à Sucre a l'Île de la Réunion. L'apoplexie (Cephalosporium sacchari Butl.).** [A new Sugar-Cane disease in Reunion. Apoplexy (*Cephalosporium sacchari* Butl.).]—*Agron. trop.*, ii, 7–8, pp. 369–374, 2 figs., 1947.

The sugar-cane disease caused by *Cephalosporium sacchari* [*R.A.M.*, xviii, p. 500; xxii, p. 153, *et passim*] has been reported from the island of Reunion. It is believed to have been present in the island for some years but has remained unnoticed owing to the absence of a susceptible plant host (until P.O.J. 2878 and P.O.J. 2961 were introduced) and the frequent occurrence of red rot (*Colletotrichum falcatum*) [*Physalospora tucumanensis*: ibid., xxvi, pp. 214, 234], which masked the other disease. Seed of P.O.J. 2961 (Selanger seedling) was first planted in Reunion in 1935. During the following year there was an outbreak of what was believed to be red rot, and this continued to occur although the original stocks and their progeny had been destroyed. Eventually it was thought that the disease was caused by a strain of *P. tucumanensis* distinct from that causing the red rot. Numerous isolations yielded *Cephalosporium sacchari*.

Artificial inoculations showed that the varieties P.O.J. 2961 and P.O.J. 2878 were those most susceptible to the disease, called 'apoplexy'. The canes first develop oily spots, several infected areas often appearing in the same field. Both the spikes and stems wilt, the latter also showing a red internal discoloration as in the case of red rot. Apoplexy can be readily distinguished from this, however, by (*a*) the primary infection of the cuttings prior to planting, which causes the young plants to die soon after emergence, (*b*) the secondary or collar infection derived from the soil after planting and causing the death of some isolated stems of young canes aged six to eight months, and (*c*) the most serious of the three, an aerial infection causing the death of mature stems during the harvest. In Reunion death of cuttings and young plants occurs very rarely, but the dry rot of the collar and stems is frequently observed. The more resistant cane varieties are Uba Marot, Co-281 [ibid., xvi, p. 774], Co-419, and R-331, 334, and 337.

Wehmeyer (L. E.). **Studies on some fungi from north-western Wyoming. IV. Miscellaneous.**—*Mycologia*, xxxix, 4, pp. 463–478, 2 figs., 1947.

The present paper in this series [cf. *R.A.M.*, xxv, p. 421] lists chiefly Uredinales and Discomycetes found in north-western Wyoming. *Taphrina alpina* [ibid., xxvi, p. 60], is reported as causing a profusely branching witches' broom growth on birch (*Betula glandulosa*). It has thick-walled, hyaline ascogenous cells, 10 to 18 by 9 to 10 μ, forming a subepidermal network or occasionally rupturing the tissue. The asci are usually hypophyllous, 21 to 27 by 8·5 to 9·5 μ, and the ascospores globose, 3·5 to 5 μ in diameter. The more noteworthy rusts are *Coleosporium solidaginis* [ibid., xxv, p. 192] on *Aster* sp. and *Pinus contorta*, *Cumminsiella sanguinea* [ibid., xxvi, p. 469] on *Mahonia aquifolium*; *Melampsora albertensis* [ibid., xxvi, p. 187] on *Pseudotsuga mucronata* and aspen (*Populus tremuloides*); *Melampsorella cerastii* [ibid., xx, p. 387] on *Picea engelmanni* and *Abies lasiocarpa*; *Puccinia coronata* on *Shepherdia canadensis*; and among the Hymenomycetes, *Exobasidium vaccinii* [ibid., xxvi, p. 129; xxii, p. 489] on *Menziesia ferruginea* and *Vaccinium membranaceum*.

Ramakrishnan (T. S.) & Ramakrishnan (K.). **Additions to fungi of Madras—II and III.**—*Proc. Indian Acad. Sci.*, Sect. B, xxv, 6, pp. 178–187; xxvi, 1, pp. 7–12, 2 pl., 10 figs., 1947.

Included in this critically annotated list of additions to Madras fungi (part I of which appeared in *Proc. Indian Acad. Sci.*, Sect. B, xxv, 1, pp. 7–12, 1 pl., 5 figs., 1947) are *Entyloma dahliae* on *Dahlia variabilis*; *Septoria erythrinae* n.sp., producing small, angular, pale green spots on *Erythrina* leaves; and *S. thespesiae* n.sp., which forms on the foliage of *Thespesia populnea* [a common shade and fence tree] circular, amphigenous, isolated or confluent lesions, 4 to 15 mm. in diameter, blackish-brown with a grey centre on the upper surface and sepia-coloured on the lower.

Filiform, hyaline, straight or bent conidia of *E. dahliae* were borne on fasciculate conidiophores on the upper surface of the leaves, imparting a white, ropy, reticulate appearance to the surface. The black, subepidermal, globose, ostiolate pycnidia of *S. erythrinae* measure 150 by 90 μ and the cylindrical, straight, triseptate, hyaline, subsessile pycnidiospores 36 to 58 by 4 to 6 (average 44 by 4) μ. *S. thespesiae* is characterized by globose, innate pycnidia, 74 to 96 by 63 to 111 (88 by 93) μ, and cylindrical, straight, bi- to sexseptate, hyaline, subsessile pycnidiospores, 9 to 37 by 2 to 4 (28 by 4) μ.

Thirumalachar (M. J.). **Doenças causadas por fungos dos gêneros 'Elsinoë' e 'Sphaceloma' em Misore (sul da India).** [Diseases caused by fungi of the genera *Elsinoe* and *Sphaceloma* in Mysore (South India).]—*Arq. Inst. biol., S. Paulo*, xvii, 4, pp. 55–66, 8 figs., 1946. [English summary.]

The following species of *Elsinoe* and *Sphaceloma* on hosts of economic importance are described from Mysore with critical annotations: *S. oleanderi* on *oleander*, *S. terminaliae* [*R.A.M.*, xvii, p. 348] on *Terminalia bellerica*, *S. santali* on sandal, *S. spondiadis* [ibid., xxii, p. 179] on *Spondias mangifera* [*S. pinnata*], *Sphaceloma curcumae* on turmeric (*Curcuma* sp.), *E. fawcetti* on citrus [ibid., xxiii, p. 14], *S. punicae* on pomegranate [ibid., xxii, p. 180], and *S. fici* Thirumalachar n.sp. on *Ficus glomerata*.

S. oleanderi produces on oleander foliage irregular or circular, densely aggregated, slightly raised, whitish lesions with black margins, 1 to 4 mm. in diameter, which gradually extend over the whole surface, resulting in severe defoliation.

In conjunction with *Oidium* sp. and *Asterina congesta*, *S. santali* contributes to the premature defoliation of the sandal, a very valuable source of revenue in Mysore. The spots on the upper leaf surface are ashen-grey, sometimes with a

purplish-black tinge, and impart a dark to black appearance to the affected areas.

Spondias pinnata is of some economic importance, its unripe fruits being used in the pickling industry. The fructifications of the Mysore species of *Sphaceloma* attacking this host are considerably larger than those reported for *S. spondiadis* from Florida and Brazil, the acervuli of the former, for instance, measuring 150 to 250 μ in diameter as against 30 to 150 μ for the latter. However, in the absence of facilities for a comparative study the Indian fungus is provisionally referred to *S. spondiadis*.

S. punicae causes a severe disfigurement of pomegranate fruits in the form of purplish-black, pulvinate, confluent lesions tending to harden or rupture the peel. The fungus has been reported from Italy (as *Hadrotrichum populi*), Brazil, and Argentina, but the pomegranate is a native of Asia and investigations in the orchards of India, especially the north-east, might well yield valuable information as to the original habitat and geographical distribution of the pathogen.

S. fici produces on both surfaces of *F. glomerata* leaves circular or somewhat irregular spots, 2 to 4 mm. in diameter, with whitish, papery centres and greyish margins. The species is characterized by erumpent, intraepidermal, circular or elongated acervuli, 28 to 144 by 26 to 34 μ, and pale yellow conidiophores, up to 15 by 2·4 μ; conidia were not observed.

THIRUMALACHAR (M. J.). **Brief notes on the genera Stereostratum Magn. and Anthomycetella Syd.**—*Mycologia*, xxxix, 3, pp. 334–340, 7 figs., 1947.

From an examination of material of *Phyllostachys bambusoides* collected by Kiyoshi Aoki in Japan in 1933 and forming part of Sydow's Fungi exot. exs. No. 953 the author gives a description of the morphology of the bamboo rust, *Stereostratum corticioides*, of which only the uredo- and teleutospores are known, and a brief history of its nomenclature. As the teleutospores possess three germ pores and develop in succession from the base of the hymenium, the genus has been tentatively included in the Pucciniosirae.

CUNNINGHAM (G. H.). **Notes on classification of the Polyporaceae.**—*N.Z.J. Sci. Tech.*, A, xxviii, 4, pp. 238–251, 10 figs., 1946.

The delimitation of genera and species of the Polyporaceae may be implemented by the use of such microscopic features as hyphal systems, series, types, and colour, basidial types, and context inclusions.

The family comprises three hyphal systems, monomitic, dimitic, and trimitic. In the monomitic system the hyphae are of the generative series alone, long and ribbon-like, twisted and collapsed, or rarely closely interwoven, ranging from 3 to 16 μ in diameter, brown or hyaline, thin-walled, septate, and branched. They serve to form the hymenophore in the absence of skeletal or binding series. Clamp-connexions may or may not be present.

The hyphae of the dimitic system belong either to the skeletal or generative series, and may be brown or hyaline, with or without clamp-connexions, and of one or other general type 'bovista' or 'long'. 'Bovista' hyphal types, so called by reason of their resemblance to the capillitium of the genus *Bovista*, may be dissected out readily and are common to species with hyaline, floccose context, e.g., *Polyporus betulinus* and *P. sulphureus*. Each consists of a main stem 3 to 10 μ in diameter, producing several lateral branches, which in turn may be branched and tapered towards the ends. They occur in hyaline species with a dimitic, and in both hyaline and brown with a trimitic system. The 'long' type is composed of slender hyphae which may ramify in the context for several millimetres, either in a continuous parallel band or loosely interwoven. They range from 3 to 7 μ in diameter and may taper towards the ends; knotting or twisting sometimes occur.

The binding hyphae present in species with a trimitic system also fall into the 'bovista' and 'long' types, those of the former being freely branched, aseptate, and with a main stem 3 to 9 μ in diameter, and those of the latter sparsely or richly branched, 2 to 4 μ in diameter.

Three basidial types are described, namely, 'merulioid', 'honeycomb', and 'clavate'. Merulioid basidia are hyaline, long-cylindrical, 12 to 30 by 3 to 4 μ, persistent, and compacted into a gelatinous, firm layer, usually arising from a subhymenium of densely woven hyphae. The spores are usually cylindrical or allantoid, except in a few *Merulius* spp. Basidia and the subhymenial tissue are commonly separated from the tissues of the context, a feature common to *M.* spp.

Basidia of the honeycomb type are clavate or oval, 8 by 4 μ, stain readily, and are laterally cemented at the base into a palisade. When they finally collapse the cemeted basal layer persists on the tramal wall, presenting a honeycomb-surface aspect and occasionally showing perforations of the cut edges like those of a postage-stamp. The hyphae of all but three of the 32 species of this basidial type are brown.

The clavate type is the most common, the basidia (occasionally elongate-clavate or fusoid) varying in length from 6 to 25 μ and arising from a two- or three-layered subhymenium. They are not infrequently mixed with ends of skeletal hyphae, which may project beyond the hymenial layer into the pore cavity and have then been termed paraphyses or cystidia.

Clamp-connexions are present in all hyaline species with a monomitic system, in most hyaline species with a dimitic system, and in all species, whether hyaline or brown, with a trimitic system.

An outline is given of the microscopic features of the species (about 100) so far examined.

Heim (R.). **Sur les caractères des Polypores en culture artificielle.** [On the characters of the Polypores in artificial culture.]—*C.R. Acad. Sci., Paris*, ccxxv, 10, pp. 421–423, 1947.

Cultural characters have been found in the author's experiments, covering a ten-year period, to furnish important clues to the determination of various species of Polypores, notably of the genera *Ganoderma* and *Xanthrochrous*, which sometimes present considerable difficulties in this respect. On Sabouraud's medium, for instance, the cultures of *G. lucidum* are bi-coloured, endopigmented, radially furcate, heterogeneous, even cerebriform in diffuse light; of *G. applanatum* concentrically zonate, multi-coloured, endopigmented, heterogeneous; of *G. resinaceum* homogeneous, monochrome, with a diffusible exopigment and profuse exudate; and of *G. curtisii* perfectly homogeneous, without exudate or pigment. Other distinctive characters are brought into prominence by the use of various standard media, while particularly interesting results have been obtained on a substratum based on albumen from *Gleditsia triacanthos* seeds.

X. [*Polyporus*] *perennis* is the only one of the numerous species of this genus studied to produce non-pigmented cultures, confirming its exceptional status already indicated by the absence of spinules, the terricolous habitat, the peculiarity of the stipe, and the rapid seasonal growth. According to Bourdot and Galzin, *X. tamaricis* and *X. corruscans* are merely varieties of *X. rheades*, but on Sabouraud's medium the former produces chrome-yellow and the latter chocolate-brown colonies. On the other hand, *X. tamaricis*, which the above-mentioned authors distinguish from *X. ribis*, is culturally similar to the latter, though not identical. Finally, *X. versatilis* proved to be culturally indistinguishable from *X. corruscans*.

In the foregoing examples the cultural characters of the species have served to correct deductions based on observations of the fruit bodies in nature. In the case of *X.* [*Fomes*] *pini* and *X. abietis* (the agent of severe damage to firs [*Abies* spp.]

in the Swiss Juras), the morphological differences between the two species are corroborated by cultural divergences, the colonies of the latter, for instance, being more delicately filamentous and fainter in colouring than those of the former. The likenesses between the two species, however, point to a close mutual relationship and also to *X.* [*P.*] *cuticularis*. Absolutely identical cultures were produced by *Ungulina marginata* and *U.* [*F.*] *pinicola*, occurring on hardwoods and conifers, respectively, which confirms a suspicion already entertained as to the identity of the two forms.

Other observations deal with the close relationship between *Melanopus* [*P.*] *squamosus* and *P. forquignoni*, the two cultural forms of *Spongipellis* [*P.*] *spumeus*, and the independent status of *P. castaneae*.

Hahn (G. G.). **Analysis of Peck's types of Meliola balsamicola and Asterina nuda.**—*Mycologia*, xxxix, 4, pp. 479–490, 1 pl., 1 fig., 1947.

A recent study of Peck's two type specimens, *Meliola balsamicola* and *Asterina nuda*, on *Abies balsamea* revealed that they are distinct species of different genera. *M. balsamicola*, a rare fungus on green balsam fir needles, belongs to the Perisporiaceae (Phaeodidymae) and probably to the genus *Dimerium*. Further intensive study of the species is necessary. The preferred name for *Asterina nuda*, common on dead fir needles, is *Adelopus nudus* (Pk) Hoehn. *A. balsamicola* is considered a synonym [*R.A.M.*, xxv, p. 51]. The involved synonymy of this species is discussed and morphological data given for both species.

Hahn (G. G.). **A new combination for Brunchorstia gibbosa.**—*Mycologia*, xxxix, 4, pp. 494–495, 1947.

The species *Brunchorstia gibbosa* was erected by Wollenweber in 1931 [*R.A.M.*, x, p. 626] and has been reviewed recently by Ettlinger [ibid. xxv, p. 588]. In the present paper it is stated that Boyce, who collected the material originally from cankers of Douglas fir (*Pseudotsuga taxifolia*), sent some also to Dearness, who named it *Cryptosporium boycei* [ibid., viii, p. 66]. A consideration of this genus, however, shows that the fungus cannot be included in it, but that the correct name should be *B. boycei* n. comb. with the synonyms *B. gibbosa* and *C. boycei*.

Blister blight of Tea.—*Plant. Chron.*, xlii, 3, pp. 49–50, 1947.

The Tea Scientific Officer of the United Planters' Association of South India believes that the adjustment of the time of pruning will assume fundamental importance in blister blight [*Exobasidium vexans*] prevention and control [*R.A.M.*, xxvi, p. 358]. Under local conditions the succulent leaf and green shoots of newly pruned tea are most susceptible to infection, and it is here that the pathogen usually appears first on individual estates, gradually spreading to bushes pruned two, three, and four years ago. The new growth developing on tea within a few months of pruning is liable to complete destruction, and when the fungus eventually dies down and growth is once more resumed, tufts of small shoots may arise from a point round the branch where one shoot was attacked. It is imperative that as many bushes as possible should have been pruned long before the incidence of blight tends to reach a climax. With this object in view, the safest procedure would be to avoid all pruning between 15th February and 1st September at the earliest, thereby providing four clear months for the development of new growth while the disease is quiescent. In the case of an abnormally late monsoon the resumption of pruning may have to be postponed for another six weeks or two months.

Blister blight affects Ceylon Tea.—*Plant. Chron.*, xlii, 3, pp. 50–51, 1947.

Writing in *The Times of Ceylon Mail Edition*, C. H. Gadd gives an outline of the distribution of blister blight [*Exobasidium vexans*] on tea [see next abstracts] in

Ceylon [*R.A.M.*, xxvi, p. 514], where it was first reported from Dolosbage on 25th October, 1946. The disease appears to be most prevalent on estates at an altitude of over 1,500 ft. above sea-level. Spraying operations on a sufficiently large scale for effective control are regarded as impracticable except in nurseries, and the plucking and destruction of infected leaves is therefore recommended as an alternative. Experiments have shown that about a fortnight elapses between the establishment of the spore and the formation of the blister on the leaf.

Tubbs (F. R.). **Blister blight.**—*Tea Quart.*, xix, 1, pp. 9–17, 1947.

This paper, read at the Seventh Conference of the Tea Research Institute, Ceylon, in February, 1947, deals with blister blight (*Exobasidium vexans*) of tea in Ceylon [see preceding and next abstracts]. The author stresses the importance of studying the behaviour of the disease in Ceylon rather than relying on the reports from India, where there may be differences in the behaviour of the fungus owing to dissimilar climatic conditions or other conflicting circumstances. As the incubation period of the disease is long it is likely that the isolated outbreaks reported subsequently to the first at Dolosbage [loc. cit.] were distinct from, and not a result of, the original outbreak. New outbreaks occurred with increasing frequency from November, 1946, until the beginning of January, 1947, when a decline set in. The range of elevation increased until it occurred above 6,500 and below 500 ft., the majority of reports coming from elevations of about 4,000 ft., where most large estates are found. It is noteworthy that it appeared in Uva during the period of the north-easterly winds.

Spraying of nursery bushes should be carried out once at the end of the dry weather and then, subject to experience, once a week during fair periods.

In the discussion which followed the paper late tipping was not recommended owing to the danger of much infectable material being left on the bush for a longer period, so encouraging rapid multiplication and spread of the disease. One of the most convenient sprays for protecting uninfected foliage is perenox at 1 oz. to 2½ gals. water applied whenever new leaves are produced; this spraying, however, does not mitigate the effects of infections which have already occurred.

Recording the incidence of blister blight.—*Tea Quart.*, xix, 1, pp. 20–22, 1947.

This article is the substance of a circular issued by the Ceylon Tea Research Institute to estates in April, 1947. Blister blight of tea caused by *Exobasidium vexans* [see preceding abstracts] causes most damage in recently pruned fields, where the whole of the new growth may be destroyed, and least in fields in full plucking. Therefore the time of pruning may have to be adjusted in order that bushes may be in their most susceptible stage when the incidence of the fungus is likely to be least. It is suggested that estates should record observations of the relative susceptibility of the different fields during the year, indicating severity under one of the following headings by using the relevant numeral: 0, disease absent or difficult to find; 1, disease apparent as white blisters on leaves, blisters per bush not very numerous, some bushes unaffected; 2, white blisters numerous but stems unaffected; 3, many young stems somewhat damaged but not killed throughout their length; 4, young stems severely damaged, many completely destroyed. Normally two records per month, one at the middle and one at the end, should be sufficient but sometimes four may be necessary in young fields. Where fields are divided into areas the pruning dates for each area should be recorded separately and no area should be larger than can be pruned in a fortnight. Further advice is given regarding notes to be added, design of record sheet (a sketch of which is given), and methods of filing and recording.

Smith (T. E.). **Hereditary defects in the T.I. 448 A Tobacco and its hybrids.**—*Phytopathology*, xxxvii, 6, pp. 424–426, 1 fig., 1947.

During the development of flue-cured strains of tobacco resistant to bacterial wilt [*Xanthomonas solanacearum*] at the North Carolina Agricultural Experiment Station [*R.A.M.*, xxv, p. 189] a parasitic disease and two hereditary defects were observed on T.I. 448 A and its hybrids. The pathogen, *Olpidium brassicae* [ibid., xxv, p. 88], destroyed over 90 per cent. of the plants in the four- to six-leaf stage of one hybrid line in 20 sq. yds. of bed. The most prominent symptoms of the blight were chlorosis and withering accompanied by brownish root decay.

Another disease, characterized by stunting, brown root decay, and withering in hot weather, was suggestive both of the foregoing seedling blight and ammonia toxicity, but was shown to be due to neither cause. All single-plant selections of T.I. 448 A were susceptible, and healthy seedlings could not be grown in steam-sterilized soil either in outdoor beds or in the greenhouse. High soil temperatures mitigated the severity of the disorder, to which flue-cured varieties were uniformly resistant. The F_1 of such varieties crossed with T.I. 448 A made normal growth, indicating the dominance of resistance.

Among the F_2 population of 1,518 plants arising from crosses between T.I. 448 A and flue-cured varieties, 2·24 per cent. were affected by a leaf spot. Typical symptoms of the condition were white and brown necrotic lesions on the lamina, combined with brown cankers of the primary and secondary veins. Leaf-breaking of the larger cankers on the primary veins was also observed. The cause of the disturbance is unknown. Washed tissue from young lesions was sterile on potato dextrose agar and the leaf spot was not transmitted by grafts. Resistance appeared to be dominant in breeding tests. The secondary vein lesions resembled a 'physiological weakness' reported by J. Johnson (*Genetics*, iv, pp. 307–340, 1919) in Little Dutch Cuban hybrids.

Mills (W. R.). **Tomato race of late blight overwintering on Potato tubers in Pennsylvania.**—*Plant. Dis. Reptr*, xxxi, 6, p. 230, 1947. [Mimeographed.]

Potato tubers infected by blight (*Phytophthora infestans*) from nine Pennsylvanian counties were examined in order to determine whether the tomato strain of *P. infestans* [*R.A.M.*, xxvi, p. 428] overwinters on potato tubers and the relative occurrence of the potato and tomato strains. All isolates from counties which grow few tomatoes were of the potato race. Isolates from counties growing both tomatoes and potatoes were predominantly of the tomato race.

Allard (H. A.). **Early reports of destructive attacks of late blight on Tomatoes in England.**—*Plant Dis. Reptr*, xxxi, 6, p. 231, 1947. [Mimeographed.]

The severe epidemic of late blight (*Phytophthora infestans*) [*R.A.M.*, xxvi, p. 220, and preceding abstract] on tomatoes in the eastern United States in 1946, which resulted in an estimated loss of $40,000,000, induced the author to review reports of early outbreaks of the disease. According to various sources destructive attacks of tomato blight occurred in England in 1875 and 1878, in the latter year practically all outdoor tomatoes being killed. It appears that a heavy attack one year does not presage another the succeeding year, but incidence depends on seasonal conditions.

Waterman (Alma M.). **Rhizosphaera kalkhoffi associated with a needle cast of Picea pungens.**—*Phytopathology*, xxxvii, 7, pp. 507–511, 2 figs., 1947.

The discoloured needles of 25-year-old blue spruce (*Picea pungens*) trees undergoing severe defoliation in a 15-acre planting at Litchfield, Connecticut, in the spring of 1938 bore pycnidia of *Rhizosphaera kalkhoffi* [*R.A.M.*, xi, p. 136], not previously reported from the United States though recorded by Macrae and Con-

ners on the same host from Canada [ibid., xxi, p. 121 (recorded on p. 87)]. The needle cast has since been observed in New York State, Virginia, Maine, and Massachusetts. The pycnidia and spores agree with Bubák's type specimen and description (*Ber. dtsch. bot. Ges.*, xxxii, pp. 188–190, 1914). In pure culture on bacto malt extract medium the ovoid, unicellular, hyaline to brown-tinged pycnospores measure 7 to 9·8 by 4·4 to 6·6 μ, compared with 7 to 10 by 3 to 5 μ in nature.

The fungus appears to proceed from the lowest branches upwards, the first symptom of infection, usually observed in the late summer, being a yellow mottling of the mature needles of the current season's growth. In some of the discoloured areas small tufts of brown, thick-walled hyphae are found protruding from the stomata. Occasionally a few needles on the newly formed twigs turn purplish-brown, and in the spring the pycnidia develop above the stomata on all surfaces of the needles. The small, white, waxy mass normally occupying the stomatal aperture adheres to the top of the pycnidium until maturity. In severe outbreaks of *R. kalkhoffi* the infected needles are usually shed during their second summer, leaving only those of the current season's growth. The intact terminal buds continue to put out new growth each year, but the gradual weakening of the twigs through premature defoliation results in stunting of the fresh needles and their susceptibility to the pathogen. The progress of the needle cast is very slow and significant damage is largely confined to the basal branches, decreasing the ornamental value of the trees.

Satisfactory control of the disease in a group of selected trees in the Connecticut planting was effected by three applications at fortnightly intervals of 4–4–50 Bordeaux mixture plus casein, beginning in the latter part of June. During the two seasons covered by the experiments the progress of the needle cast was arrested by the treatment on trees with the lowest branches defoliated by the fungus, while neighbouring spruces with only slight infection were adequately protected from further spread of the disease.

Hahn (G. G.). **Berg's rust resistant Red Cedar susceptible to Phomopsis juniperovora in greenhouse tests.**—*Phytopathology*, xxxvii, 7, pp. 530–531, 1947.

Two red cedar (*Juniperus virginiana*) seedlings grown from clones reported by Berg to be highly resistant to cedar-apple rust (*Gymnosporangium juniperi-virginianae*) [*R.A.M.*, xx, p. 98] were tested by the author at New Haven, Connecticut, in 1946, for their reaction to *Phomopsis juniperovora* [ibid., xxii, p. 481], the inoculations being performed in August by a method previously described [ibid., vi, p. 327]. Lateral branches, 3 to 4 mm. in diameter, inoculated near the trunk, died back to the main axis. When the inoculum was applied to the trunk (7 mm. in diameter at the point of incision) girdling ensued and the terminal was slowly killed. Within two months erumpent sporulating pycnidia developed round the sites of inoculation. Reisolations in early December of *P. juniperovora* from diseased inner bark tissue resulted in the production on malt extract agar of a yellow coloration and red crystals, two specific characters of the parasite first recognized in 1917 (*J. agric. Res.*, x, pp. 533–40, 1917) and since proved to be of great diagnostic value.

Hatfield (W. C.). **Shoot blight of Aspen and Poplar caused by species of Fusicladium.**—Abs. in *Univ. Wyo. Publ.* (formerly *Univ. Wyo. Publ. Sci.*), xii, 1–4, pp. 73–74, 1946.

Three species of fungi are stated to be concerned in the etiology of aspen and poplar shoot blight, viz., *Fusicladium radiosum* [*Venturia populina*: *R.A.M.*, xix, p. 387], *F. elegans* (Servazzi) Solheim and Hatfield n. comb. (= *Pollaccia elegans* Servazzi) [loc. cit.], and *F. lageniformis* Solh. & Hatf. n.sp. Inoculation experiments with the two last-named showed that *Populus alba* var. *bolleana* was the

most susceptible of the species tested, followed in descending order by *P. tremuloides*, *P. nigra* var. *italica*, *P. angustifolia*, and *P. sargentii* (which was apparently immune from *F. elegans*).

In cultural studies of the same two pathogens the optimum growth temperature was 25° C. for *F. elegans* and 20° for *F. lageniformis*, the corresponding optima for spore germination being 15° and 20°, respectively. The addition to potato dextrose agar of autoclaved yeast and thiamin chloride resulted in enhanced density and luxuriance of growth and, in the case of *F. elegans*, in a recrudescence of sporulation. Both species utilized dextrose, lactose, levulose, mannose, and sucrose, singly or in combination, on non-nutrient agar: their growth was not affected by the addition to several media of asparagine and peptone.

Goidànich (G.). **Sulle cause dei cedimenti nella pavimentazione del Palazzo Corsini, dell' Accademia Nazionale dei Lincei.** [On the causes of subsidences in the flooring of the Corsini Palace, the seat of the National Academy of the Lincei.] —*R.C. Accad. Lincei*, Ser. VIII, i, 7–8, pp. 872–880, 4 figs., 1946.

Subsidences in the flooring of the Corsini Palace, an eighteenth-century building, have resulted from a deterioration in the supporting timber due to a form of dry rot caused by a wood-destroying Basidiomycete, probably *Merulius lacrymans*. It is thought that the timber was infected when originally laid down and that decay was favoured by damp and lack of aeration. Fungal activity probably ceased, however, at least a century ago; the vegetative organs of the causal organism and of the accompanying superficial microflora were unrecognizable microscopically, and could not be cultured. The pendulous mycelium consisted of hyphae 2·5 to 3 μ thick with septa 50 to 60 μ apart, with isolated intercalary swellings 5 to 7 μ in diameter, and of other, thin hyphae without visible septa. These hyphae were thickly coated with calcium oxalate. The mycelium of the rhizomorphs was more regular, measured 2 to 2·5 μ in diameter, and showed very little coating.

The author advises the replacement only of the timber no longer possessing the minimum mechanical resistance. Experiments showed that two strains of *Coniophora cerebella* [*C. puteana*] and *Polyporus vaporarius* [*Poria vaporaria*] grew readily on the unaffected parts of the wood, but failed to grow even under optimum environmental conditions on the infected part and that immediately beneath.

Rodigin (M. N.). Видовой состав домовых грибов в Башкирской АССР. [An account of house fungi in the Bashkir Autonomous Soviet Socialistic Republic.] *Trud. Bashkirsk. Selsk. Xozd.* [*Bull. Bashkir agric. Inst.*], v, 2, pp. 35–37, 1946.

In 1939 the damage caused to wooden buildings in Bashkir (especially in Ufa) assumed alarming proportions and the Phytopathological and Entomological Agricultural Institute in Bashkir examined many of the buildings and made numerous wood analyses. From 1939 to 1944 the following wood-attacking fungi were identified: *Merulius lacrymans* (widespread) [*R.A.M.*, xxvi, p. 370], *Poria vaporaria* (very common) [loc. cit.], *Coniophora cerebella* [*C. puteana*: loc. cit.], *P. vaillantii* [ibid., xxv, p. 20], *Paxillus acheruntius*, *Peniophora gigantea*, *Lenzites sepiaria* [loc. cit.], *Corticium seriale*, *Trametes* [*Fomes*] *pini*, and *Ceratostomella pilifera*.

Davidson (R. W.), Lombard (Frances F.), & Hirt (R. R.). **Fungi causing decay in wooden boats.**—*Mycologia*, xxxix, 3, pp. 313–327, 4 figs., 1947.

In this survey of decay in boats [cf. *R.A.M.*, xxiv, p. 346] wood-rotting fungi were obtained only from about one-third of the samples from which isolations were attempted. This was due either to the fungus being inactive in the selected wood, or to the fact that other moulds had invaded the decayed wood so completely that it was impossible to isolate the causal fungus. In some samples the fungus obtained

may not have been the cause of the principal damage but in general those most frequently recovered are believed to be among the more important species causing decay. An important new oak-rotting fungus [ibid., xxii, p. 333], *Poria oleracea* n.sp., which causes a brown rot in oak heartwood is described as developing light buff to tawny pores 1 to 4 mm. long in patches 3 to 6 mm. across before shrinking; basidia 9 to 13 by 4 to 6 μ; hyaline basidiospores 5 to 7 by 2 to 3 μ, somewhat pointed at the ends; and broadly ovoid, smooth-walled, abundant, hyaline chlamydospores, 5 to 10 by 3 to 6 μ. The type sporophores developed on white oak wood in flasks from cultures isolated from rot in oak. In 14 days a cottony fungus mat 7 to 8·5 cm. in diameter is formed, the optimum growth temperature being approximately 30° C.

Other species important in causing hardwood decay were *Daedalea quercina* and *Stereum frustulosum* [*S. frustulatum*]. Those causing softwood decay were, in descending order of frequency, *P. microspora*, *P. xantha*, *P. carbonica*, and *Lenzites sepiaria*.

Foster (A. A.). **Acceleration and retardation of germination of some vegetable seeds resulting from treatment with copper fungicides.**—*Phytopathology*, xxxvii, 6, pp. 390–398, 1 graph, 1947.

At the Central Florida Experiment Station, Sanford, Detroit Dark Red beet, Glory of Enkhuisen cabbage, Arlington White Spine cucumber, Black Beauty eggplant, Telephone pea, California Wonder [chilli] pepper, and Bloomsdale spinach seeds were germinated in Petri dishes, steamed soil, and soil inoculated with *Pythium*, *Corticium*, and *Fusarium* spp. after seed treatment with copper sulphate (one hour's immersion in a 1·5 per cent. solution at room temperature) or cuprous oxide (ten minutes' revolution in Erlenmeyer flasks containing dosages of 0·38 per cent. for cucumber and peas, 0·75 per cent. for cabbage, eggplant, chilli, and spinach, and 1·13 per cent. for beet).

The germination of cabbage, cucumber, and peas was reduced or delayed by the treatments [*R.A.M.*, xvi, p. 307; xvii, p. 219; xxvi, p. 459 *et passim*], whereas that of beet, eggplant, chilli, and spinach was increased or accelerated. Nitroprusside tests showed that the three kinds of seeds in the copper-sensitive class contain sulphydryl groups which are absent from those of the tolerant sorts. Copper sulphate and cuprous oxide were found to penetrate pea and cucumber seeds and destroy those sulphydryl groups. Moistening with 10 ml. of a 0·1 per cent. aqueous solution of cysteine hydrochloride partially restored the germinative capacity of pea seeds injured by copper sulphate. Cuprous oxide damage to pea seeds was expressed by a decrease in the dry and fresh weights of embryos from seeds germinated in Petri dishes, and in a reduction in respiration of peas but not in spinach.

In fungus-infested soil the injurious effects of the chemicals may be masked, the treated seeds showing much higher germination than the untreated where these damp off badly. For example, with cucumber seed copper treatments appeared beneficial, whereas peas benefited only with cuprous oxide, and non-treated cabbage seed germinated better than treated. In the presence of high concentrations of active pathogens with plants that are liable to damping-off the grower can afford to ignore the injurious effects of chemicals.

Meuli (L. J.), Thiegs (B. J.), & Lynn (G. E.). **The zinc salt of 2, 4, 5-trichlorophenol as a seed fungicide.**—*Phytopathology*, xxxvii, 7, pp. 474–480, 1947.

The zinc salt of 2, 4, 5-trichlorophenol proved superior to the other phenol derivatives tested at the Dow Chemical Company, Midland, Michigan, for the control of pre-emergence mortality of pea, Lima bean [*Phaseolus lunatus*], groundnut, and lettuce seedlings caused by such soil-inhabiting pathogens as *Rhizoctonia* [*Corticium*] *solani*, *Pythium*, and *Fusarium* spp. It was also effective in the reduction

of cotton seedling infection by *Glomerella gossypii* when applied to naturally contaminated seed before planting. Dosage rates have been established only for a few species of seeds, but the usual recommendation of 2 to 4 gm. per kg. for large seeds like cotton would in all probability be generally applicable. The zinc salt of 2, 4, 5-trichlorophenol should be used at a concentration of 30 to 50 per cent. and combined with an inert diluent.

Foster (H. H.). **Comparison of benzene vapour with certain sprays in the control of downy mildew of Cauliflower.**—*Phytopathology*, xxxvii, 6, pp. 428–431, 1947.

Experiments having demonstrated the efficacy of benzene vapour in the control of cabbage downy mildew (*Peronospora parasitica*) in Mississippi [*R.A.M.*, xxiv, p. 259], the fumigant was tested on cauliflower suffering from the same disease [ibid., xxiii, p. 247]. The results, however, were unsatisfactory, the treatment (45 applications between 8th November, 1945, and 11th January, 1946, at 50 c.c. per sq. yd.) being not only ineffectual against the pathogen but actively toxic to the plants, which were severely stunted and frequently killed in the early seedling stage. The best control in this series of tests was given by wettable spergon (4 lb. plus ½ lb. orvus per 100 gals.) applied bi-weekly between 9th November and 31st December, 1945. The plants had a disease rating of 1, representing vigorous growth with a mere trace of infection or slight necrosis on one or two lower true leaves, and an average weight per 100 plant tops of 765 gm. The disease rating for Dow seed protectant No. 5 (2 lb. plus ½ lb. orvus per 100 gals., bi-weekly) was 1·5 (fairly robust growth, a few necrotic lesions on the lower true leaves with some chlorosis and occasional defoliation), and for the unsprayed 3, expressing mediocre growth, with more or less stunting and usually some destruction in the early seedling stage, general foliar necrosis, often accompanied by a varying degree of stem discoloration; the corresponding average 100-plant weights were 442 and 403, respectively. For benzene vapour the disease rating was 4, connoting marked stunting, usually considerable loss of seedlings, extensive foliar necrosis, and shedding of the lower leaves; the plants are commonly weak, with discoloured stems, the latter and the roots often invaded by secondary rot-producing organisms. The average 100-plant weight in the plots receiving this treatment was only 99 gm.

Gordienko (F. I.). Природа и пути инфекции главнейших бактериозов Капусты и обоснование способов борьбы с ними. [Nature and methods of infection of the principal bacterioses of Cabbage and measures for their control.]—52 pp., 8 figs., Ukraine agric. Exp. Sta., Kharkov, 1940. [Received January, 1947.]

This study deals with the two principal bacterioses of cabbage in the U.S.S.R. In Ukraine and the northern and western parts of the country the greatest damage is attributed to black rot caused by *Bacterium campestre* [*Xanthomonas campestris*: *R.A.M.*, xx, p. 331], the physiological properties of which are described.

A new bacterial disease called by the author slimy bacteriosis (*Bacterium* sp.) was discovered actively spreading in a hot-bed in the winter of 1934 in the Kharkov district on cabbages at the heading stage. The extremely virulent bacteria destroyed the intercellular substances and in some cases were found in the cells. They showed Gram-negative reaction and when grown in pure culture on peptone agar they formed shallow, round, dirty white colonies with smooth, slimy surfaces and even edges.

Inoculation tests resulted in 50 to 100 per cent. infection of early, medium, and late cabbage varieties. Undamaged plants were also infected up to 100 per cent. Some of the characters were identical with those of *Bacterium carotovorum* [*Erwinia carotovora*].

In the seed-bed stage oily spots appear on the leaves which rapidly spread over the whole surface; the plants wilt and eventually die. During the heading phase

the infection appears on the margins of young leaves. The lamina often becomes puckered and sometimes breaks. The diseased parts wilt, and become thin, brown, and transparent. When young leaves are attacked the plants have a rosetted appearance. In unfavourable conditions for the development of the bacteria the disease does not progress in the leaves but remains at the stage of a marginal necrosis. In such cases the cabbage can develop a normal head and if the disease is not too severe the infected plants can give a yield. In 1937 on a State farm in the Kharkov district 100 per cent. destruction occurred in 44 ha. Both bacterioses can kill 90 to 100 per cent. of plants at an early stage. Potassium and mineral fertilizers in combination with manure applied on different soils reduce both bacterioses. Out of 12 cabbage varieties examined none was found to be fully resistant to both diseases. The late variety Zabadovka was the most resistant to black rot. The control measures recommended are: disinfection of the hot-bed frames and soil, seed treatment with mercuric chloride, crop rotation, use of mineral fertilizers, and the destruction of vermin, litter, and all crop remains. The effectiveness of these measures minutely followed was proved on a State farm where infection was only 0·9 per cent. and the yield 225 quintals [1 quintal = 100 kg.]. Further studies are recommended, especially to secure resistant varieties.

Rose (A. S.). **Nicotine against the yellows virus of Sugar Beets.**—*Brit. Sug. Beet Rev.*, xv, 2, pp. 66–68, 1946. [Abs. in *Sugar*, xlii, 9, p. 51, 1947.]

Six uniform beet plots were artificially populated by green aphids [? *Myzus persicae*: *R.A.M.*, xxv, p. 532] that had previously fed on beets infected by the beet yellows virus [ibid., xxvi, p. 520], a similar uninfested group serving as controls. Forty hours later 3 per cent. nicotine dust was applied to all the plants at the rate of 40 lb. per acre, and two further treatments were given during the following ten days, thereby preventing the spread of the virus from the diseased to the healthy beets. Three weeks after infestation all the beets in the aphid-populated plots showed foliar yellows. The average total weights of the roots in the healthy and diseased groups of plots were 130 and 83 lb., respectively, and the corresponding sugar content 14·6 and 13·8 per cent., respectively. The calculated beet yields per acre from the uninfested and infested beets were 12½ and 8 tons, respectively.

Coons (G. H.), Stewart (D.), Deming (G. W.), Gaskill (J. O.), Henderson (R. W.), Lill (J. G.), & Nuckols (S. B.). **Report on tests in 1945 of U.S. 215×216 and other varieties from Sugar Beet leaf-spot-resistance breeding investigations of the U.S. Department of Agriculture.**—*Proc. Amer. Soc. Sug. Beet Technol., 1946*, pp. 206–209, 1947.

During 1945, agronomic evaluation tests were carried out in 13 localities (four in Colorado, one each in Wyoming, Montana, Nebraska, Iowa, Minnesota, and Ohio, and three in Michigan) with the first and third releases of U.S. 215×216 and other sugar beet varieties obtained in the federal leaf spot (*Cercospora beticola*) resistance project [cf. *R.A.M.*, xxv, p. 101]. As the disease caused only minor damage, the comparisons made related mainly to the agronomic characters of the varieties, leaf spot resistance being a relatively slight factor.

The three releases of U.S. 215×216 form valuable additions to American sugar beet varieties. The third (made in 1945), tested as S.P. 4–7–00, and designated U.S. 215×216/3 is definitely a sugar type. All three are highly resistant to leaf spot, particularly the third, which is recommended for and will be allocated to all areas where leaf spot is severe. Its ability to produce a high sucrose content even under conditions of leaf spot exposure may prove very important. U.S. 215×216/1 or /2 will probably continue to be utilized as the all-round leaf spot resistant types, high in root yield and moderate in sucrose. The evidence obtained suggests that more

emphasis should be laid on breeding for specific adaptation, including disease resistance, and combining these factors with those affecting productiveness.

Murphy (A. M.). **Sugar Beet and curly top history in southern Idaho 1912–1945.**—*Proc. Amer. Soc. Sug. Beet Technol., 1946*, pp. 408–412, 1 fig., 1 graph, 1947.

The rapid expansion of sugar beet production in southern Idaho in 1912 was abruptly checked in 1919 by the first very severe outbreak of curly top [*R.A.M.*, xxvi, p. 370]. The yearly acreages and yields from 1912 to 1945 are tabulated and show that the leafhopper [*Eutettix tenellus*] invasion forecasts by the United States Department of Agriculture Entomology Bureau were generally beneficial in encouraging or discouraging planting. Control by planting resistant varieties began in 1935, after which good yields were obtained every year. When U.S. 22 [ibid., xxiii, p. 284] came into general use, the entire acreage of southern Idaho was planted with it in 1942. In that year it gave a yield of 16·84 tons per acre.

Owen (F. V.), Murphy (A. M.), & Ryser (G. K.). **Inbred lines from curly-top-resistant varieties of Sugar Beets.**—*Proc. Amer. Soc. Sug. Beet Technol., 1946*, pp. 246–252, 2 figs., 1947.

While much has already been achieved by mass selection in the development of sugar beet varieties resistant to curly top [see preceding abstract], improved methods have become imperative. This paper records the results of inbreeding experiments with a self-fertile curly top resistant variety. A 12 per cent. advantage in sugar production per acre over present commercial varieties was obtained with the hybrid S.L. 4108 (from S.L. 1–121 as ovule parent and the self-fertile CT9 as pollen parent). Not merely has the use of inbred lines proved feasible to secure resistance to curly top, but also resistance to minor diseases and to bolting. The very high degree of curly top resistance now available in the S_3 generation of CT9 makes it possible to consider using it or its male-sterile equivalent in crosses with varieties not resistant to curly top, if increased vigour or greater sugar content can be obtained in such hybrids.

Bennett (C. W.). **Foreign virus diseases potentially dangerous to the Sugar Beet industry in the United States.**—*Proc. Amer. Soc. Sug. Beet Technol., 1946*, pp. 394–404, 1 fig., 1947.

Descriptions are given of the symptoms, host range, varietal susceptibility, and transmission of three serious virus diseases of sugar beet not yet reported from the United States, viz., yellows [*R.A.M.*, xxvi, p. 277], found in Europe, Argentine curly top [ibid., xxv, p. 245], and yellow wilt [ibid., xxv, p. 532] found in Argentina. The dangers ensuing from the introduction of these diseases are discussed.

Notice of lifting of the domestic Dutch Elm disease quarantine.—*B.E.P.Q., S.R.A., U.S. Dep. Agric.*, 2 pp., 1947.

Owing to the inadequacy of the Federal quarantine measures in controlling the spread of the Dutch elm disease [*Ceratostomella ulmi*] by its principal carrier the bark beetle [*Scolytus multistriatus*], Notice of Quarantine No. 71 is revoked as from 1st May, 1947.

The quarantine measures were rendered useless owing to the extensive flying powers of these insects, the distribution of which is known to be much wider than was thought when the quarantine was last revised [*R.A.M.*, xxii, p. 112]. The transportation of elm logs and firewood, which provide a ready source of infection, is largely local and the limited long-distance transit can best be controlled by the action of individual States. Nursery stock is not a potential source of infection as carrier either of the disease or the bark beetle. The possibilities of controlling short-distance spread by artificial means were reduced by the discontinuation of the rigid control measures in some areas where the disease was well established.

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